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ORIENTATION TO COMPUTER ASSISTED INSTRUCTION FOR PHYSICALLY HANDICAPPED GRADE ONE STUDENTS

by

© MAUREEN ROSINA BUTLER

A THESIS

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Henry R. Fred
Supervisor

Darius R. Young

S. Hunka

Date March 29 1983

To my nephew, Russell

ABSTRACT

The purpose of this study was to orient physically handicapped grade one students to computer assisted instruction. A problem-solving approach, the nursing process, comprised of four phases--assessment, planning, implementation and evaluation--was adapted as the research methodology.

A sample of 16 grade one students with a wide range of physical handicaps was selected for the study. A detailed profile was prepared for each student to delineate all areas of functional ability.

The equipment used was a Texas Instruments TI-99/4 microcomputer. A peripheral speech synthesizer was used for some students.

Four programs commercially produced by Texas Instruments, Inc., were used as courseware. Content of each program was evaluated prior to use in terms of provincial curriculum for grade one studies, school objectives, classroom texts and student level of comprehension.

The orientation consisted of group instruction followed by individualized practice by pairs of students during which time pre-, post- and retention tests were administered. Anecdotal analyses of observations are presented.

Each child was able to become familiar with the equipment, to operate it or tell others how to do so and to

demonstrate comprehension of the concepts presented. Each child also demonstrated progress toward the multidisciplinary therapeutic goals associated with his or her physical handicaps--an unanticipated gain.

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CHAPTER I

INTRODUCTION

> *. . . You are a child of the universe*
> *no less than the trees and the stars;*
> *you have a right to be here. And whether or not it is clear to you, no*
> *doubt the universe is unfolding as it*
> *should . . .*
>
> Desiderata
> (Found in old Saint Paul's,
> Baltimore; dated 1692)

Clearly, our universe is unfolding at an exponentially rapid rate. Knowledge, behaviours and beliefs are subject to constantly changing comprehension and evolving practices.

Within this societal environment, all individuals are in need of orientation or insight into these ever-evolving new situations, so that they and others can become aware of their status within a given circumstance. Effective orientation, whether self-determined or planned by others, is critical to ensure successful embarkation into that which is new and heretofore unknown.

For a segment of society, computer expertise is several decades old. For many of the populace, however, this technology with its extended and ever-expanding capacities, although potentially available to most if not all of the population, still remains an area of mystique or threat. Applications of computer technology in the field of education have been escalating in the last two decades. These applications have, however, been somewhat limited by two major constraints--the high cost of equipment and expertise. These constraints are rapidly becoming minimized. The previously expensive, massive stationary equipment accessible primarily to those affiliated with institutions of higher learning and major corporations has been, since 1975, transformed and demystified. Today's microcomputer, a general purpose small computer, is sufficiently understandable, affordable and portable that many people are now using them, even for everyday activities in their own homes (Doerr, 1979).

The evolution of computer technology has created a dramatic new range of career opportunities in support of the design, development and research of both the equipment and its application. Computer applications have also significantly altered the scope and functions of a wide range of traditional careers--a continuing process. Further, computers are no longer the pervue of adults only, but also within reach of children and their everyday world in that even children's toys have become computerized. Toys to children are the tools with which they work, providing stimuli to their cognitive, psychomotor and affective development.

Another aspect of change within our society is our values and beliefs about other human beings. Recognition and appreciation of individual differences has been coupled with recognition and appreciation of individual rights. We are currently in a state where such recognitions, when not offered, are being demanded. Within this understanding, physically handicapped people are no longer stigmatized for being different but, rather, are gaining recognition of their right and need to develop their unique abilities to the fullest as does everyone else.

Within these contexts it seems reasonable to expect that physically handicapped people may well find that computers can serve as a vehicle which will assist in enhancing their abilities and minimize their disabilities. Secondly, computer technology may provide physically handicapped people with a new and wider range of vocational opportunities in which they are able to be successfully competitive in the open job market. A third assumption then follows: that computer applications may potentiate the abilities of physically handicapped children if introduced into the teaching-learning process at the outset of the child's formal education.

Evolving from these assumptions, this study examines the functional abilities of a selected group of physically handicapped young children in relation to their initial orientation to a microcomputer, using simple drill and practice computer assisted instruction, as an adjunct to their learning. It describes a central activity of the initial stage of a major research project developed to investigate the spectrum of prevocational and vocational education and training needs of physically handicapped individuals prior to employment placements (Ziel, Abrams & Butler, 1980).

Purpose

Generally, the overall purpose of this study was to determine whether physically handicapped children, given their special needs, could operationalize a microcomputer. If a positive effect could be demonstrated, then further exploration of the relevance of computer technology and its applications to prevocational education for physically handicapped children would be warranted.

The major objective of this descriptive study was to plan and implement an orientation to computer assisted instruction for physically handicapped Grade one students. In order to meet this objective, a careful assessment was a necessary prerequisite. Evaluation of the effectiveness of such an orientation was necessary to determine the implications.

More specifically, the orientation was designed to teach the students to operationalize a selected microcomputer and thereby access commercially produced software which was affirmed by their teachers to be appropriate to the Grade one level of learning. Based on a comprehensive appraisal of the whole child, synthesized into a knowledge of the functional abilities of each, the orientation was to be accomplished through group instruction followed by individualized tutoring of pairs of students.

Problem

The central problem was four-fold and can be generally stated as follows:

1. Can physically handicapped Grade one students, through an orientation process, become familiar with the physical operation of a microcomputer?
2. Can physically handicapped Grade one students, once familiarized, interact with this equipment utilizing simple drill-and-practice programs?
3. Will this adjunct to teaching enhance physically handicapped Grade one students' learning?
4. Can computer assisted instruction enhance the ability of physically handicapped Grade one students to demonstrate that learning has occurred?

Delimitations

This study was confined to 16 multi-handicapped Grade one students (two of three classes) enrolled in the Glenrose School Hospital (G.S.H.), Edmonton, Alberta, during the 1979-80 academic year.

Heads of all departments represented on the multi-disciplinary team--medicine, physical therapy, occupational therapy, psychology, speech pathology and audiology, nursing, social services, and education--were fully informed and approved of this study. Although departmental consultation was described as a public relations activity, the Department of Medicine held full veto power--despite prior approval-in-principle by the Administration, the Research Committee and the school authorities. Inherent in the approval was the understanding that the study would in no way adversely affect academic standards or learning activities, nor would it interfere with or deter required therapies and treatments. Access to all relevant and necessary information was granted on the commitment that complete confidentiality and anonymity would be maintained.

Limitations

Major limitations of this study were associated with resources. While the support of the Glenrose School Hospital in the provision of one microcomputer plus a speech synthesizer peripheral device was profoundly appreciated, access of individual students to the hardware was therefore restricted to scheduled, brief time periods.

Commercially prepared software based on educational requirements was purchased due to the investigator's limited knowledge of programming at the time of the study.

The physical space available for the conduct of the study was severely restrictive due to renovations and other demands for space in the Glenrose School Hospital at the time. This limited opportunity for placement of the microcomputer components to facilitate accessibility by the students. As well, the safety hazards created by the manoeuvring of students, their physical support devices, the modular parts of the microcomputer plus the investigator within a five-foot by twelve-foot airless converted observation area were a concern.

Summary

Given current societal changes in the evolution of computer technology and the potentiation of physically handicapped individuals, it is suggested these two factors may indeed be combined in a manner which enhances the abilities of the physically handicapped and, perhaps, concommitantly, minimizes their disabilities. Specifically, an orientation to computer assisted instruction for physically handicapped Grade one students was undertaken as a preliminary step in examining the relevance of computer technology to prevocational education for the physically handicapped.

CHAPTER II

REVIEW OF SELECTED, RELEVANT LITERATURE

Definition of Physically Handicapped Individuals

Since physically handicapped children are central to this study, a working definition is appropriate:

> A person should be regarded as handicapped when for physical or mental reasons he encounters considerable difficulties in his daily life, has special needs besides the common ones and needs special assistance for his education, employment, integration into society, etc. . . . . (Council of Europe, 1972, p. 6)

During this review of the literature, twenty different definitions, currently in use across Canada, evolved. Each province, government agency and association appears to have its own interpretation of the words "handicapped" or "disabled."

Neither the Alberta School Act (1970) nor the Glenrose School Hospital (G.S.H.) Handbook: Education Department (Briggs, 1974) define the physically handicapped child who is integral to the educational system in this province.

Great Britain has, since 1970, passed three specific education acts which do define and classify both the physically and the mentally handicapped child, each being covered by separate acts. Further, special educational provisions from both acts addressing handicapped children are also covered in the more general, major act governing education (Warnock, 1978).

In contrast, however, it appears that most definitions include all handicapping conditions in a carte blanche statement. Such phrases as "mental and physical impairment," "mental and/or emotional problems" and "mental or physical disability" occur repeatedly in the definitions. Obviously, no one single definition categorizing all handicapped conditions is feasible. It does appear logical, however, that Canada could adopt a general definition for the physically handicapped, observing that handicap knows no provincial boundaries.

Clearly, a baseline definition is essential when attempting any study of the physically handicapped. Brown so aptly summarizes the state of the situation:

> Part of this Alice in Wonderland nature of those . . . definitions is the way in which the same words can be interpreted to mean quite different things . . . . (1977, p. 18)

The term "physically handicapped" has been used throughout this study and is defined by the investigator within the context of that delineated by the Council of Europe.

Needs Assessments for the Physically Handicapped

Recognition that the term "physically handicapped" is a generalization is essential. Individuals may have one or more specific physical handicaps and these will vary in degree for each. Therefore, it is essential to develop a framework for assessing the needs of each individual student in light of their specific limitations.

Silverman, the principal investigator for the Formative Evaluation of the Ontario Crippled Children's Centre Symbol Communication Program (1976) had, among his prime concerns, evaluation of formal assessment devices currently being utilized with non-communicating children. "To date there is no formal test battery which is organized in such a way as to provide a systematic assessment . . ." (p. 3). Silverman feels, however, that:

> In order to establish the most effective means of communication, it is necessary to carry out a physical assessment. It is essential to look at the whole child in every aspect, because all his areas of functioning are linked together--physical, mental and social--and they influence each other. (p. 73)

In his findings, Silverman identified relevant variables: (a) desire to communicate; (b) present means of communication; (c) language comprehension; (d) level of functional speech; (e) potential for speech-prognosis; (f) present development level; (g) social development; (h) present behaviour and personality; (i) present educational achievement; (j) level of intellectual functioning; (k) visual area;

(l) auditory area; (m) mobility; and (n) hand function (pp. 116-126).

While Silverman's study was limited to non-communicating children, the generalizability of his approach is evident when one recognizes that all of the children in a grade one class at Glenrose School Hospital have a speech impairment or language delay.

Reporting on their recent study, A Process of Assessment and Educational Program Development: Sequential Development Task Analysis (1979), Bomberg and Fentiman state:

> Sequential development task analysis (SDTA) is a process designed to be employed in the development and implementation of appropriate educational goals and teaching strategies for individuals within a classroom environment. The process is designed to provide a framework for the formulation of individual educational plans which promote attainment, integration and generalization of concepts and skills critical to development . . . . (p. 1)

Using Piagetian stages -- birth through formal operations (Bossard & Stoker Boll, 1966), this process (SDTA) is an assessment of the individuals' functioning in the areas of cognition, language, social-affective behaviors, motor and life skills. This provides for relatively objective identification of major levels of functioning, gaps in development, emergent concepts, learned reactions and non-integrated behaviors. Parents as well as teachers participate in identifying current and future goals. The assessment forms developed for SDTA, while very comprehensive, were too complex to be of value within the limitations of this study.

The AAMD Adaptive Behavior Scale was designed to rate behaviours of the mentally retarded, emotionally maladjusted and developmentally disabled, and was purported to be generalizable (Fogelman, 1975). Areas included in this scale appear to be of secondary importance to this study in that they focus primarily on beginning social behaviours and knowledge.

The work of Evans in assessment and evaluation of "special needs learners," focusing on vocational education, identifies eight broad variables which appear useful and relevant for the purposes for which it was intended (Allbright, Fabac & Evans, 1978). Within the context of this study, however, the indicators are expressed in terms of greater maturity than is relevant for Grade one students.

The Glenrose School Hospital educational psychologists were, at the time of this study, adapting Gunzberg's (1977) progress assessment charts for use at the school. As the adaptations were not yet completed and the original was designed primarily to assess the mentally retarded, the materials were inappropriate for the focus of this study.

When a multidisciplinary team approach is utilized, regardless of the setting, there exists a constant danger--that of the establishment of "territorial rights." Warnock (1978) suggests: ". . . any team which is hospital-based is likely to develop a predominantly medically oriented approach--it is less likely to be suitable for those {children} who, though they need special educational provision, do not require hospital treatment" (p. 62).

Other literature which addressed needs assessments appeared to be even more lacking in the fundamental criterion for which the investigator was searching--functional indicators which would reflect the wholeness of the individual being assessed.

Microcomputers: The State of the Art

The spatial conceptualization held by consumers of computers as large mechanical devices began to change with the miniaturization market breakthrough of 1975. Since then continuation of the miniaturization has led us to the situation we are in today--ranging from children's toys to home usage, microcomputers are among the most common, inexpensive pieces of technology found in our current society. This evolution in terms of size reduction in functional equipment is probably now reaching a terminus. The hand-eye coordination capacities of the operator, essential to the human-machine interaction--remain a futile limit on this progression (Doerr, 1979; Evans, 1979). New peripherals, however, which bypass the need for hand-eye control through electro-mechanical sensors and effectors (Brown, 1978) are evidence of the fact that seemingly reasonable projections of ultimate capacity are being continually contradicted by further breakthroughs in manners not previously perceived possible. These recent developments have further implications in terms of potential users. Whereas, once, the individual's hand-eye control capacities were considered the overriding developmental and physical criteria for effective operation of the computer, it is now possible for individuals lacking in training and dexterity (e.g. children and the physically handicapped) to operationalize this equipment.

In previous decades, computers have been introduced into the field of education very slowly, primarily with adults studying in fields of higher learning. Attributes such as cost, autonomy, flexibility and reality have meant that microcomputers now offer educators opportunities for applications at the individual school level not previously considered feasible (McLean, 1980).

The potential for achieving more efficient and effective education through the microcomputer is, however, still dependent upon the concomitant requisite of educationally sound, well designed, competently programmed software. In the race to develop software to meet the demand created by the technological advances of hardware, some of the commercially produced software does meet the above three criteria. However, there is an understandable tendency of profit-oriented industry toward vigorous exploitation of the toy and game market, with a greater emphasis on appeal rather than results. The developmental merits of games are not all denied: "Educators and children alike have long advocated games as a playful way of learning" (Barstow, 1979, p. 116). Kearsley (1977), Muller (1971) and Spencer (1978) further support this view. Interestingly, Larsen (1981) cautions that children should not be permitted to play commercially produced computer games until after they have "become accomplished programmers" (p. 69).

The research of Liedtke and Stott (1979) demonstrates that children enjoy making up and participating in their own games and are knowledgeable and enthusiastic about establishing rules and procedures. Learning was observed to take place in these playful activities.

> Just as an adult works, so does a child play; it is the business of childhood. It is through play that a child grows, learns, develops and ultimately matures . . . . Attitudes toward work (his play) which he develops in these early years will be important in shaping the kind of workman he is during adult life. (Marlow, 1977, pp. 47, 728)

The question remains: Do commercially prepared games utilize game theory in such a manner as to promote and stimulate the analytical thinking in the user which is an essential element of learning through play?

Claims of the merchandizers that the mass-produced commercial software market does indeed serve educational needs are not entirely unfounded and are indeed supported. Wiechers (1980) asserts that Texas Instruments' "Little Professor" and "Speak and Tell" computers offer "programs similar to or better than those available on sophisticated CAI {sic} systems" (p. 66). Conversely, others such as Forman (1981) argue that "the microcomputer courseware available on the commercial market was developed initially by programmers with no background in education. The result was courseware which, for the most part, was trivial in educational content and inferior in instructional design" (p. 15). While these views may be debatable, there are elements of truth inherent in each, which merit consideration.

In summary, the dilemma today is that, in order to utilize the now accessible microcomputer hardware for educational purposes, high quality educational materials must be available. Today's problems and issues surrounding courseware are influenced by such factors as: (a) the incompatability of much of the hardware and software currently available; (b) the need for standardization vis-a-vis the desirability of "instructional autonomy"; (c) the cost of programming locally, which can be internally reproduced, in contrast to the cost of purchasing commercial programs for each microcomputer used in the classroom; and (d) the need for programming which provides for flexibility and adaptation such that it permits the exercising of critical reasoning in a problem-solving approach by both the teacher and the student. Integral to all of these, of course, is the need for a minimum, sufficient computer literacy on the part of both the teacher and the student, so that the technology can be utilized to its full potential and the software evaluated to the extent that the inferior materials will be eliminated and the educationally sound software will be fully utilized and further developed (Hallworth & Brebner, 1980; Hunka, 1981; McLean, 1980, Travers, 1981).

Implications of Computer Assisted Instruction for the Handicapped

Little research has been conducted, to date, in the field of computer assisted instruction for the handicapped. Most of the research which has been done has focused on the mentally handicapped. Holtz (1979) cites the work of Sandals who "used CAI {sic} . . . to teach banking skills to the mentally handicapped," Hallworth, Brebner and Brown's indication that "mentally handicapped can learn social skills through their interaction with CAI," and Strain who during this research, "designed a CAI system to teach simple buying skills to the mentally handicapped" (pp. 3-4). Holtz' own research with the mentally handicapped has been to investigate the effectiveness of computer assisted instruction for teaching both basic money-handling skills (1979) and a social sight vocabulary (1976); auditory support was employed in the latter.

The development of special computerized terminals, peripherals and courseware has been a major thrust of the National Research Council since 1967. Under Brown et al. (n.d.), this research recognized the special learning needs of mentally retarded, culturally deprived, physically handicapped and other students exhibiting learning difficulties.

Ottawa Hospital for Crippled Children, under the auspices of the National Research Council, conducted a study using a VOTRAX speech synthesizer as a terminal component to assist severely physically handicapped children--as an example, the cerebral palsy child with no means of verbalization. Until this time, such children had only been able to use a Blissymbolics Board (Bliss, 1965) for expressive communication. Because children with cerebral palsy usually have little manual dexterity, input controls, COMHANDI, were designed and developed to assist these children. A matrix board displaying Blissymbols was added to the terminal, permitting the child to express himself to others. As a result of this early research, staff at the hospital are now being educated and trained to use a computer system programmed with Blissymbolics (Brown, n.d.).

In a continuous five-year study to look at the "use of the computer as an adjunctive teaching resource tool in elementary and secondary education for special needs children," Sandals (1979) took his research into classrooms within the school system rather than the more artificial settings provided by large research centres as had been done previously. His objectives were to develop programs including curriculum materials in math, language arts and social skills which would meet the needs of individual schools, and to examine innovative applications of microcomputers to computer assisted learning. Results, to date, with regard to physically handicapped students are, in summary, that the use of the keyboard in the drill and practice of computer assisted learning is an excellent therapy for students with orthopedic handicaps, and that deaf students find they are not handicapped through using computer assisted learning and thus are highly stimulated.

The elementary school for the physically handicapped used a microcomputer based polymorphic system with a speech synthesizer and Blissymbolic Board as peripherals. The study is still in progress.

Summary

This chapter reviewed selected literature. The investigator has sought a definition of the term "physical handicap" and finds that most definitions give a carte blanche statement incorporating mental/physical handicap/disability.

Assessment literature tends to reflect the professional discipline bias of the originator rather than attempting to meld concepts which would lead to a "whole person" appraisal.

The literature indicates that microcomputer technology advancements have so far outdistanced development of software and, that unless educators become directly involved utilizing their educational base coupled with computer literacy, current problems will be compounded.

Finally, a brief review was provided of Canadian research examining computer assisted instruction for handicapped children.

CHAPTER III

INVESTIGATIVE APPROACH

Design

The strategy used in this study is that of descriptive research. Abdellah (1965) defined a descriptive study as "research conducted at a natural setting where there is little control over the study, subjects and setting" (p. 19).

The research methodology is that of the nursing process, a problem-solving approach.

> The nursing process is the core and essence of nursing; it is central to all nursing actions, applicable in any setting, within any frame of reference, any concept, theory or philosophy. . . . it is organized, systematic, and deliberate. (Yura & Walsh, 1978, p. 1)

A schematic representation of the nursing process is provided in Figure 1.

While similar to any other scientific approach to problem solving, the nursing process is simple in that it comprises only four interacting phases: assessment, planning, implementation and evaluation, and is therefore easily employable.

The critical phase, assessment, provides for data collection, analysis and priorization. The effectiveness of the other phases are dependent upon the quality of the assessment. Planning incorporates exploration of

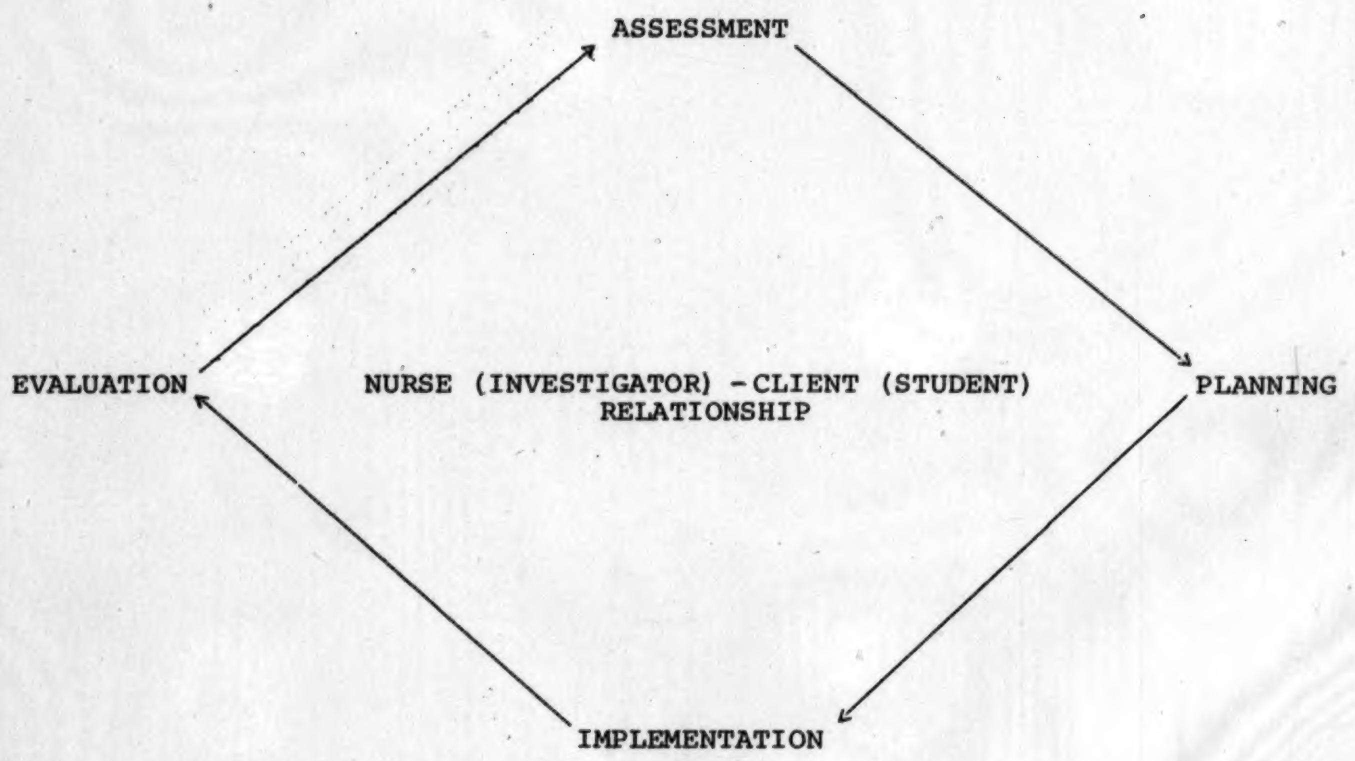
ASSESSMENT
PLANNING
IMPLEMENTATION
EVALUATION
NURSE (INVESTIGATOR) - CLIENT (STUDENT) RELATIONSHIP

Figure 1. Schematic Representation of the Nursing Process

alternatives and devising methods to resolve problems. The initiation and completion of necessary actions to accomplish defined goals is described as the implementation phase. Evaluation represents appraisal of the implementation in terms of the assessment and plan.

Assessment

Students

In order to ascertain the current methods of student assessment used at G.S.H., specific interviews, staff discussions and department observations were used. This confirmed that each child is a unique individual with a complexity of needs and a variety of limitations. They appear equal, from a research point of view, only in the areas of sex and chronological age.

The master file of each student currently enrolled in grade one was reviewed. The information recorded in the file utilizes a multidisciplinary team approach, with each of the professionals collaborating in assessing, planning, implementing and evaluating a "coordinated" regime for each individual student. Team members have tended to utilize assessment tools and detailed records customary to the practise of their own disciplines, resulting in a voluminous accumulation of data. An instrument was developed to summarize the pertinent information required for this study (see Appendix A).

The data provided by the hospital's department of computing research provided students' individual diagnostic codes. These were interpreted by the investigator using the International Classification of Diagnosis (1978). From the classification of each student's medical diagnosis, a population profile of the G.S.H. students was developed (see Appendix B). This profile demonstrated that the physical handicaps of students in grade one are generally representative of the school population as a whole.

While the representativeness of the students selected has minimal relevance for this descriptive study which, by definition, acknowledges limited control over the subjects, this factor was deemed important to the major research project to which this study contributed. It is reported here for two reasons: (a) this type of analysis, though technically simple, had not heretofore been undertaken; and (b) the potential for generalizability, given that G.S.H. is a regional centre serving the northern half of the province of Alberta, may be of interest.

Equipment

Hardware

The equipment used in this study was a Texas Instruments TI-99/4 microcomputer with a peripheral speech synthesizer. The variables considered prior to purchase of this equipment were: (a) size of keyboard and keys; (b) spacing between keys; (c) sensitivity of the keys to touch; (d) type of operational controls; (e) size of monitor screen; (f) clarity of picture and audio; (g) colour intensity and control; and (h) modular construction in terms of the potential users who are physically handicapped.

The Texas Instruments TI-99/4 microcomputer featured more of the desirable characteristics than other models available on the commercial market at the time. The keyboard, 55 cm. in length, was a slim-line, compact, modular and light weight unit, thus easily portable and readily transferred to a tray across a wheelchair or body frame. The keys were flush to the keyboard with 1 cm. space between each thus minimizing the chance a child could depress two keys at once. For children with limitations in fine motor control of the hands, a keyboard with larger keys would have been preferred. The small keys of the TI-99/4 were, however, acceptable given their high degree of tactile sensitivity. The electrical on/off slide and turn controls were easily adapted to a one line push button switch. The 32.5 cm. square monitor screen had excellent picture clarity, ease of color control and a 16 color range for graphics. The audio component of the monitor was extremely clear and sound was not distorted by volume adjustment, thereby producing high quality music and voice sound effects. Unfortunately, in contrast to the keyboard, the monitor was very heavy, thus not readily portable. Insertion of the solid state software module into the keyboard unit, which was easily made accessible, could be accomplished in one simple action by a child who had only limited, gross motor control.

Courseware

The courseware, which consisted of four commercially produced solid state software, was assessed by the investigator and Grade one teachers. Content of the modules was evaluated in terms of the objectives for Grade one studies (Alberta Education, 1978), the G.S.H. objectives, classroom texts and the student level of comprehension. The following software was selected:

Module 1, Early Learning Fun (Texas Instruments, Inc., 1979), includes four categories of learning activities: numbers, shapes, sorting and the alphabet.

Module 2, Number Magic (Texas Instruments, Inc., 1979), includes activities beginning with drill and practice in basic skills and moves to more advanced problems in addition, subtraction, division and multiplication.

Module 3, Beginning Grammar (Texas Instruments, Inc., 1979), introduces the basic parts of speech and how they are used: nouns, verbs, pronouns, adjectives, prepositions and conjunctions.

Module 4, Speech Editor (Texas Instruments, Inc., 1979), utilizes the vocabulary of the speech synthesizer.

The Texas Instruments solid state software modules were selected due to their correspondence to materials traditionally introduced in Alberta's Grade one curriculum. Texas Instruments had designed and developed this software in consultation with leading educators.

From a teaching-learning point of view, the Texas

Instruments software appeared to have many potentially effective qualities. All children are natural manipulators of objects; the software creates opportunities for learning by doing in requiring step-by-step interaction with the computer. This interaction not only teaches the necessary keyboard skills in order to use the keyboard effectively, it also reinforces the numeric and alphabetic characters, a major requisite of the Grade one level of formal education. For these young learners, the potential for confusion between the letter O and the numeric 0 on the keyboard was recognized and the need for reinforcement in the orientation was noted. The software was designed to appeal to the child's fascination with music, color and animation. A correct keyboard entry was rewarded by music and colorgraphics. Error response provided an audible signal and instant encouragement for the child to try again. Error correction appeared to be easily accomplished. The added feature of the speech synthesizer could allow non-verbal communicating children to become totally involved in this new learning activity. The modules selected provide a sufficient range of content to allow students of varying levels of cognitive development to interact with the microcomputer.

Subject Selection

Selection of Grade one students to participate in this study was made in consultation with the school principal and members of the teaching staff. Sixteen physically handicapped students (two Grade one classes of eight students each) were selected for the study. Appendix C summarizes the multidisciplinary team appraisal of each student.

Stanford Binet I.Q. measurements were available for only 12 of the 16 students. These ranged from 68 to 117, with a mean of 91.5. Educators responsible for the Stanford Binet appraisals reported they were unable to ascertain these measurements due to the nature of the physical handicaps of the remaining four students.

At the time of initiating the study, the students' chronological ages ranged from five years, eight months to seven years, nine months, the mean being six years, nine months.

Group 1 was a class of eight students for whom speech and/or language delay superseded other handicaps as factors influencing the choice of teaching strategies. This group was considered by the school to be a "senior" Grade one class, functioning educationally above the other two Grade one classes in the school.

One month following the commencement of this study, the homeroom teacher of the intended Group 2 was injured in an accident. In the interest of the students and substitute teachers, a new Group 2 of eight Grade one students was selected. For the purposes of this study, this change did not unduly alter the sample in that this group of eight students had a range of severe physical handicaps which required innovative strategies to permit the students to demonstrate that learning had occurred. The change did, however, mean that the teacher of Group 1 students actively participated in the planning phase from the outset. Group 2's teacher, on the other hand, did not become as actively involved until just prior to implementation.

Classroom Observation

An integral part of the assessment phase was direct observation of the two groups of students selected for the sample in the classroom, their natural learning environment. The investigator was introduced to each group of students by their respective homeroom teachers and, for a period of three school days, assumed the role of a teacher's aide, working with the students.

This period of direct observation through participation allowed the investigator an opportunity for partial validation of the previously developed multidisciplinary team appraisal summary for each student (see Appendix C).

The functional capabilities of each student in the sample were of prime importance for planning activities. It became apparent that a quick reference, wholistic profile of the student's functional abilities and limitations as identified by all of the disciplines was essential for effective work with each child. The instrument developed for this purpose, "Student Profile of Functional Abilities," is presented in Appendix D.

Planning

Based on the compilation and analysis of the assessment data, the planning phase was initiated and focused on three broad areas: activities, content and instruments.

Activities

The introduction to computer assisted instruction would begin with an initial discussion and demonstration to provide for a group process with each class of students. During the group sessions which would be spread over a three day period for each class, a module with a very elementary content would provide the basis for direct practical experience on the microcomputer.

Pretests to establish a measurement of the students' level of knowledge in each of the content areas to be chosen was deemed relevant. These would precede two, 30-minute computer orientation sessions per week over a three-week period (six sessions), where each individual student, working with a "buddy" for necessary assistance, would have "hands-on" experience on the microcomputer.

The pretests would be readministered as posttests immediately following the three weeks of practical application. At least two weeks following the posttests, retention tests would also be administered.

One of the conditions for approval of this study was a demonstration to the senior staff of the institution; this included the administrators from each of the multidisciplinary team areas. A wind-up party to express appreciation to the students as well as the staff seemed an appropriate way to fulfill this requirement.

Content

The selection of content for all learning activities planned for this study was done in full consultation with the school principal and Group 1 teacher. The content for the initial group discussion and demonstration would utilize Module 1, Early Learning Plan (Texas Instruments, Inc., 1979). This module was selected because it was recognized that its content, focusing on shape, numbers and letter recognition, counting, sorting and the alphabet, as well as beginning computer skills, was deemed to be within the scope of understanding of all students within the sample. Thus, a non-threatening learning situation should be possible.

To maintain this non-threatening climate, the pretests and posttests would be conducted in a familiar mode, paper and pencil (see Appendix E). Only the retention tests would be completed through the use of the microcomputer; the content would be programmed identically to provide for comparability. The first decision regarding choice of subject matter was a determination that there would be a combination of familiar topics plus the introduction of one new concept, which was consistent with the program of studies for elementary education (Alberta Education, 1978), but had not as yet been introduced.

Sums and differences were selected as the familiar learning content. The concept of nouns was selected as the new introductory content. During each practice session of computer assisted instruction, all three content areas would be addressed.

Instruments

Orientation to the concept and functions of a microcomputer would commence with a group "show and tell." The Texas Instruments' "Speak and Spell" and a digital calculator, currently on the toy market, would be initially introduced to demonstrate the concept of the functions which the Texas Instruments T.I.-99/4 microcomputer can perform. A large percentage (69%) of the students had some degree of speech/language delay; to minimize a complete reliance on verbal communication, the investigator designed and constructed a puppet "T.I.Tex." The puppet would ultimately be used to control the classroom environment through demonstration and actions, rather than spoken words. If the puppet could make a mistake and hit the wrong computer key, then there would be no need for embarrassment when the student did the same thing.

Posters illustrating the significant features of the keyboard were developed for display in both classrooms; the students would thus be able to identify familiar numbers and alphabet letters. The "special keys" that the student must know in order to interact with the microcomputer were also depicted.

A colouring book to reinforce all the new concepts to be presented in this study was designed and developed by the investigator after confirming with the classroom teachers that the students should be able to master the new vocabulary with phonetic presentation and reinforcement during discussions. During the group orientation session, the students would be given the book (to take home) with the intent of stimulating parent/guardian interest in this new learning activity and reinforce the new vocabulary (see Appendix F).

Summary

The descriptive research design of this study and the nursing process approach, i.e. assessment, planning, implementation and evaluation, have been described. The assessment and planning phases of this study have been discussed in depth, thereby depicting the methodology employed. Assessment focused on the students and their abilities, the hardware and courseware available, student selection and direct observation of the children selected. Planning entailed delineation of appropriate activities, determination of content and the development of necessary and appropriate instruments in preparation for the implementation phase.

CHAPTER IV

IMPLEMENTATION: DESCRIPTION, OBSERVATIONS AND ANALYSIS

The third phase of the investigation is discussed in this chapter, namely, implementation. Details of each aspect of the orientation for selected Grade one physically handicapped students to computer assisted instruction are described.

Prior to implementation, the assessment and planning described in Chapter III were presented to, and approved by, the school principal. The homeroom teacher of the children selected for Group 1 was, as has been indicated, actively involved throughout the preceding phases, allowing for frequent discussion, instruction and "hands-on" experience with the microcomputer. Unfortunately, due to the late involvement, Group 2's teacher was oriented to the microcomputer at the same time as the students. Fortunately there was time at the end of the study for further discussion and instruction.

Activities

The three-day period spent during the planning phase, observing the 16 students at work in the classroom and at play, proved invaluable. In a short time, a mutual rapport began to evolve for both investigator and students, and the perception that each student was not disabled but, rather, had varying degrees of ability (Viscardi, 1952, p. 239) was reinforced. A group orientation was conducted over a two-day period for each individual group, with the homeroom teacher and investigator both participating in the activities. The classroom had been set up the morning of orientation--day one--prior to the students' arrival. They appeared fascinated with the equipment and when asked by the investigator, "What do you think we are going to do today?" there were varied responses, from "Watch cartoons," to "No, we are going to be on television!"

Utilizing the puppet, the key parts of the microcomputer were explained. Each new word to be learned was written on the board and each letter, then word, was sounded out by the students. To introduce the concepts that were ultimately used when interacting with the microcomputer, a Texas Instruments Speak and Spell and a digital calculator were introduced as teaching aids. Each student spent time working with these aids. The new material presented to the students was then reviewed, including physical identification of the components on the microcomputer.

The second group orientation day commenced with the paper and pencil pretests (see Appendix E), during which both groups of students were supervised by the teacher and investigator. A review of material, presented the previous day, followed. The puppet and investigator then continued with a demonstration of the microcomputer in operation, commencing with the use of the speech editor module programmed to have the speech synthesizer say, "Hello, I am a Texas Instruments computer." The demonstration continued using Module 1, Early Learning Fun (Texas Instruments, Inc., 1979). Throughout this demonstration the puppet interacted with the microcomputer. Errors in entering data from the keyboard were performed, allowing each student to hear and see both negative and positive reinforcements; this resulted in a positive exchange between students and puppet (see Appendix G for photographs of these activities).

The students were initially fascinated by the toy-like appeal of the microcomputer, but quickly recognized that, although fun to operate and use, the microcomputer was controlled by a set of instructions which must be followed. Each student then selected an activity from Module 1 to work through--shapes, numbers, sorting or the alphabet, taking a turn on the microcomputer. The colouring book (see Appendix F) was given to each student to reinforce the new material learned. A brief half hour review and an explanation of the timetabling for the next three weeks completed the group orientation to computer assisted instruction.

The students were paired on a "buddy" system based on classroom observations, physical needs, compatability, and, with the teacher's approval, each received a one hour orientation (per week for the next three weeks) to computer assisted instruction.

Immediately following each orientation session, pertinent anecdotal notes were recorded using a checklist of the students' physical functions, academic achievements and specific behavioural reactions. Upon completion of this three-week period, the posttests (see Appendix E) were administered to both groups of students under supervision of the teacher and investigator.

During the next two weeks the students returned to their pre-study, routine academic schedule, allowing no further orientation to computer assisted instruction.

Two weeks later, the retention tests were administered using the same level of material as had been used in the pre/posttests, via the microcomputer mode. Group 1 was supervised by teacher and investigator, Group 2 by investigator alone. During this, the final week of study, the planned demonstration/party was held, at which time each student was presented with a "Well Done!" certificate (see Appendix H). Overall, the students appeared to enjoy their party and the opportunity to demonstrate their newly acquired skills.

Anecdotal Analysis

The heterogeneity of this group, exacerbated by the variety and complexity of each child's physical handicaps, necessitates a description of the investigator's observations of each child's behaviors and interactions throughout the orientation period. The initial comprehensive assessment data, compiled from the records (Multidisciplinary Team Appraisal Summaries, Appendix C) and the initial three-day observation/interaction, were used as a baseline from which each child's progress could be noted.

Student 1.1.1

On initial contact with this student in the classroom environment it was apparent that she was very shy and withdrawn with strangers. She was equally sensitive when asked by the teacher to introduce herself to the investigator. Her speech was very slow and at times indistinct. She demonstrated an excellent rapport with her peers in both the classroom and play environments and was both attentive and respectful towards her teacher. This student appeared to be a very bright child who worked intently on all her assignments; however, she tended to wait and copy the actions of her peers rather than listening to the instructions given. Table 1 portrays a student profile of functional abilities (also see Appendix C).

During the three-day orientation period she was very enthusiastic in all aspects of the computer functions; her total success with all the learning activities presented from module 1 led to the sharing of her achievement, verbally, with the investigator.

Her teacher requested that the student pronounce each noun as it appeared on the screen, which led to her requiring a lot of reassurance from the investigator during

Table 1

Student Profile I.D. 1.1.1

Diagnosis: Sensorineural hearing loss with secondary language delay

Age: 7 years; **Sex:** Female
Stanford Binet (IQ.): 113

Abilities	Degree of Impairment				
	None	Slight	Moderate	Severe	Total
Vision		left eye			
Hearing			right ear[a,b]		left ear[a]
Mobility					
Upper limbs	normal				
Lower Limbs	normal				
Physical Health	normal				
Language					
Expression				secondary	
Comprehension				secondary[b]	
Social/Emotional Function		shy[c]			
Intellectual Function	superior				

Notes: Therapy: Speech - daily.

[a] Wears a hearing aid.

[b] Sit in front or to the right of her when speaking; speak slowly and distinctly.

[c] Quiet, well motivated Eskimo child.

the second week of the orientation. The only other area of difficulty encountered during this period was with material relating to differences.

Although she performed the numerical calculations very quickly and accurately during week three, the difficulties with nouns continued, leading her to become very anxious and requesting to repeat the module over and over again.

She maintained a high level of enthusiasm throughout the orientation period and, at the conclusion, was able to function totally unaided throughout the sessions. Her level of confidence increased. During the final week she arrived alone and explained to the investigator why her "buddy" would be late for his session; she commenced her assignment and when her buddy arrived she chastized him and proceeded to correct him when he made errors in his assignment. She did not participate in the retention test as she went home for a holiday.

Student 1.1.2

During the first classroom contact with this student he displayed a marked lack of self-confidence when responding to verbal questioning. He was a bright, motivated little boy, who was very quick and neat with all his written assignments; however, he became very restless and easily distracted during speech/language classes. Weaknesses were noted with his vocabulary and comprehension. Table 2 portrays student profile of functional abilities (also see

Table 2

Student Profile I.D. 1.1.2

Diagnosis: Hyperactive behavior syndrome with speech and language delay

Age: 6 years; **Sex:** Male
Stanford Binet (IQ): 117

	Degree of Impairment				
Abilities	None	Slight	Moderate	Severe	Total
Vision	normal				
Hearing	normal				
Mobility					
Upper Limbs	normal				
Lower Limbs	normal				
Physical Health	normal				
Language					
Expression			*		
Comprehension			*		
Social/Emotional Function			*[a]		
Intellectual Function	normal[b]				

Notes: **Therapies:** Speech - daily; Psychology - three times weekly.

[a] Anxious, aggressive at times.

[b] Bright, motivated.

*Refer to Multidisciplinary Team Appraisal (Appendix).

Appendix C).

Problems were noted in the area of hand-eye coordination during the second week, in that he tended to look at the computer screen rather than alternate between keyboard and screen. He was very shy and reserved, requiring assistance with the noun assignment. He continued to have problems with the key controls during the third week. Being very quick with arithmetic calculations, his improvement was noted in the comprehension of nouns assignment. In the final week, first session, he was very intense when working on assignments; he smiled when prompted or corrected, but did not speak. The final session was a total reversal--if he touched the wrong key during his responses he immediately verbalized the correct answer.

Student 1.1.3

This bright, vivacious and well-motivated child responded immediately on initial contact with the investigator, using excellent verbal communication skills, but had difficulty in her written assignments. She was very capable of attempting to use manipulative techniques, as the investigator discovered while laying out her papers and pencil for an assignment: "Can you write my letters for me? I'm a cripple you know," she stated! A shorter pencil and slight pressure applied above her right wrist by the investigator allowed her to write. "The best 'M' I have done in my life" was her evaluation. Table 3 describes a summarized overall

Table 3

Student Profile I.D. 1.1.3

Diagnosis: Cerebral Palsy with spastic quadriplegia

Age: 6 years; **Sex:** Female
Stanford Binet (IQ): *

Abilities	Degree of Impairment				
	None	Slight	Moderate	Severe	Total
Vision		stimulation required			
Hearing	normal				
Mobility					
Upper Limbs				left arm	
Lower Limbs					left leg[a]
Physical Health	normal				
Language					
Expression	normal				
Comprehension		slow			
Social/Emotional Function	vivacious[b]				
Intellectual Function	normal[c]				

Notes: **Therapies:** Physiotherapy - daily; Occupational Therapy - twice weekly.

Nursing: Assistance with activities of daily living.

[a] Wears leg braces; uses wheelchair; very unsteady when transferring from chair to standing position (falls easily).

[b] Bright, well motivated.

[c] Minor manipulative behavior.

*No current assessment available.

description of student profile of functional abilities (also see Appendix C).

During week two, she continued attention-seeking behaviour, giving the impression she could not read, sounding out each individual letter, e.g. "k-ah-er" for car. When working on the noun assignment, however, she quickly and clearly identified Boston as being a place and continued the whole section in this manner, while still claiming not to understand elementary instructive words. Her attention span was very short during week three and she demanded assistance in all areas of the assignment. In the final week assistance was again given in all areas. She appeared bored and was very demanding, disruptive and attention seeking.

The situation was discussed with the Group 1 teacher; the investigator was of the opinion that this child would have been much less demanding had she been placed in a one-to-one relationship rather than having to share the investigator's attention with a "buddy."

Student 1.1.4

When first encountered in the classroom environment, this little girl was very shy and withdrawn and had great difficulty in vocalizing her name, which was finally presented in a barely audible whisper. She appeared bright, attentive and very observant during all classroom activities. During recess periods she was frequently observed singing and playing records (most times one or more of her peers were with her)--she truly had a love of music. With gentle prompting this little girl would talk; she responds well to her teacher's guidance and gentle understanding. Table 4 contains student profile of functional abilities (see also Appendix C).

This little girl became very attracted, almost possessive of the puppet. She constantly placed herself adjacent to it and appeared to delight in touching its various textures.

During the second week she remained shy and reserved, preferring practical application rather than communication. Investigator's assistance was required with calculations involving two or more digits during the third week. As her confidence increased, she was encouraged to vocalize when working on the noun assignment. By the completion of the orientation period her level of confidence was greatly improved and she worked independently, seeking approval only when completing a specific content area.

Student 1.1.5

This bright, exhuberant little boy was first encountered in a spell of aggressive behaviour towards his peers. Very shy when introducing himself to the investigator, he displayed a marked speech impediment. During the first three hours of the investigator's observation, this little boy demonstrated ten attention seeking/inappropriate

Table 4

Student Profile I.D. 1.1.4.

Diagnosis: Delayed speech and language, behavior problem

Age: 7 years; **Sex:** Female
Stanford Binet (IQ): 83

Abilities	Degree of Impairment				
	None	Slight	Moderate	Severe	Total
Vision	normal				
Hearing	normal				
Mobility					
Upper Limbs		*			
Lower Limbs		*			
Physical Health			respiratory infections		
Language					
Expression				minimal spontaneous speech	
Comprehension		English Second Language			
Social/Emotional Function			*[a]		
Intellectual Function			slow[b]		

Notes: Therapies: Speech Therapy - four times weekly; Occupational Therapy - twice weekly.

[a] Very shy Chinese girl; loves music; can be prompted to talk.

[b] Excellent work habits; requires guidance and gentle understanding.

*Refer to Multidisciplinary Team Appraisal (Appendix C).

behaviour patterns during both classes and recess.

His behaviour was discussed with the teacher who explained that he was very insecure and fearful in unfamiliar situations; no doubt the investigator's presence had exaggerated his behaviour.

On the second day of observation this boy worked intently on a "word house," displaying neat, precisely written alphabet letters. He had a keen sense of humour and, once accustomed to the investigator's presence, he demonstrated this by directing his humour toward himself first, then to the investigator, in the difficult formation of words. Table 5 contains student profile of functional abilities (see also Appendix C).

During the second week he was very hyperactive during the computer instruction session. He rushed through his assignments, demanding more and more to complete. The investigator noted that he should be allowed to make an error and slow down in order that further learning could occur. This little boy was placed on sedation at the end of the second week.

The following week there was a marked change in his behaviour. He was polite, controlled, responsive and very friendly toward his "buddy," insisting that he work first on the computer. When his turn came to work on the computer, he completed his assignment with a completely correct score, progressing during the time period to an assignment on division "by three." During the final sessions, this child

Table 5

Student Profile I.D. 1.1.5

Diagnosis: Severe speech and language delay; hyperactive behavior syndrome — **Age:** 7 years; **Sex:** Male; **Stanford Binet (IQ):** 69

Abilities	Degree of Impairment				
	None	Slight	Moderate	Severe	Total
Vision	normal				
Hearing	normal				
Mobility					
Upper Limbs	normal				
Lower Limbs	normal				
Physical Health	normal				
Language					
Expression			articulation*		
Comprehension	above average				
Social/Emotional Function				hyperactive[a]*	
Intellectual Function	above class average				

Notes: Therapies: Psychotherapy - intensive; Speech Therapy - four times weekly; Occupational Therapy - twice weekly.

Nursing: Medication program to control behavior.

[a] Can be very physically aggressive with other children.

[b] Bright, exuberant little boy.

*Refer to Multidisciplinary Team Appraisal (Appendix C).

displayed happy, cooperative behaviour. Having completed all the prescribed assignments, he was permitted to progress to the more complex multiplication and division "by four."

This child demonstrated the most marked progress of all students in the sample.

Student 1.1.6

Small and finely built, this child, when first observed in the classroom environment, appeared withdrawn and shy. He worked very intently and conscientiously with his written assignments; however, he had a tendency to rush when working with mathematical problems, becoming very self-conscious and withdrawn when he made an error. He displayed a keen sense of humour, was well liked by his peers and thoroughly enjoyed group interaction with them. Table 6 describes a summary of student's functional abilities in profile (see also Appendix C).

During the first week this boy required assistance with mathematical calculations, however he could verbalize the correct answer upon immediate questioning. He frequently moved forward and backward in his chair, toward and away from the screen, leading the investigator to question whether he might have a not-yet-diagnosed visual deficiency. During the following week, his assignments were performed very quickly, with a great deal of enthusiasm displayed including asking pertinent questions about the computer. There appeared to be an improvement in his manual dexterity. During the final two sessions, this child performed very

Table 6

Student Profile I.D. 1.1.6.

Diagnosis: Motor/mental developmental retardation; convulsive disorder; delayed speech and language

Age: 6 years; **Sex:** Male
Stanford Binet (IQ): 68

Abilities	Degree of Impairment				
	None	Slight	Moderate	Severe	Total
Vision	normal				
Hearing	normal				
Mobility					
Upper Limbs	normal*				
Lower Limbs	normal*				
Physical Health		seizures			
Language					
Expression				lacks fluency	
Comprehension				auditory processing	
Social/Emotional Function			timid dependent*		
Intellectual Function		educable			

Notes: **Therapies:** Speech Therapy - weekly; Occupational Therapy - biweekly.
Nursing: Requires protection, direction for activities of daily living.
*Refer to Multidisciplinary Team Appraisal (Appendix C).

intently, completing all his assignments, but did not speak at all!

Student 1.1.7

When asked by the teacher to introduce himself to the investigator at the time of first contact, this little boy physically withdrew into his chair, became teary-eyed and buried his head as he curled himself into a foetal position. During the second session, he appeared more relaxed. Although not overtly responsive, he was observed to cast slight sideways eye movements in the direction of the investigator. Part of the third observation period was spent having the investigator work with him on a mathematics assignment; at this time he had progressed to communication through facial gestures and body language. He worked well independently, producing accurate, neatly written work. He appeared to seek approval but did not respond when this was given. A very slow, gentle approach was required when working with this child, with the provision of much love and reassurance. Table 7 portrays a profile of student's functional abilities (see also Appendix C).

During the group orientation period, he was the only child among Group 1 to make a series of errors with the elementary level learning activity. He again withdrew into himself physically and no amount of reassurance from the puppet, investigator or teacher could, at this point, resolve the situation.

Table 7

Student Profile I.D. 1.1.7

Diagnosis: Speech and language delay; elective mutism

Age: 6 years; **Sex:** Male
Stanford Binet (IQ): 88

Activities	Degree of Impairment				
	None	Slight	Moderate	Severe	Total
Vision		photo-sensitivity			
Hearing	normal				
Mobility					
Upper Limbs	normal				
Lower Limbs	normal				
Physical Health	normal				
Language					
Expression				articulation disorder	
Comprehension			delayed reception		
Social/Emotional Function				withdrawn[a]	
Intellectual Function			low average functioning[b]		

Notes: Therapies: Psychotherapy - three times weekly; Speech Therapy - twice a week; Occupational Therapy - twice a week.

Nursing: Anticipate needs, will not vocalize.

[a] Withdraws upon direct confrontation; needs gentle, supportive approach.

[b] Has obvious academic potential.

During the first intensive session, week two, this boy displayed withdrawn behaviour, refusing to "enter" onto the computer. His "buddy," however, was able to encourage him, getting him to sit down and then demonstrated how to proceed. By the second session he appeared much more relaxed and to be trying hard to achieve; he was able to achieve all the prescribed assignments.

The third week brought an almost completed reversal of behaviour. He preceded his buddy into the room, sat down at the computer, turned it on, selected his module, inserted it and proceeded to work through his assignment achieving, again, a perfect score! As each correct score was displayed, accompanied by the programmed positive reinforcement, he responded with smiles and gestures of delight. As his "buddy" progressed with his turn, thereby occupying the investigator's attention, this boy suddenly climbed, uninvited, onto the investigator's lap where he remained until the end of the session.

Therapies necessitated rescheduling and assignment of a new, functionally slower, "buddy" during the final week. When leaving the classroom to go to the "computer room" with the investigator and his new "buddy," this child took the key from the former's hand and ran ahead. By the time the investigator arrived, he had the computer operational and was working through his assignment. He performed all functions very quickly. Due to his high level of excitability he pressed the wrong key, then, realizing his own error, he spontaneously verbalized the correct answer. Throughout his "buddy's" session he paced up and down the room, became more agitated and excitable, jumped on and off the investigator's knee, and finally he verbally chastized his "buddy" as he left the room.

Throughout these sessions, this boy's teacher and, via the teacher, the multidisciplinary team members were kept informed of his behavioural changes, as were his parents on an occasion when they had reason to come to the school. At this point, following consultation with the school principal and teacher, the boy was asked if he would like to demonstrate what he had learned, during this orientation to computer assisted learning, to the visitors at the class party. He responded with nods, smiles, and a weak "yes." On the day of the demonstration/party, upon the investigator's request, he commenced his demonstration, executing it with controlled, robot-like, precision. To the audience's round of applause for a "job well done," his acknowledgement was to put his head down, walk across the room to his classmates, and withdraw.[1]

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[1] While writing up these findings, in hindsight, the investigator questions whether the request to demonstrate was "pushing" this child too far too quickly, in appreciating his earlier improved behaviours. Follow-up questioning of staff indicates that he continues to make slow but consistent progress.

Student 1.1.8

Upon first contact, this child was unable to pronounce his name clearly when introduced to the investigator. He was easily distracted from classroom proceedings, preferring to play with a teddy bear and an alligator puppet which were on his desk. At 1530h, promptly, he interrupted the teacher, reminding her that it was "home time" as he prepared to dash out of the classroom. Overall, he was a very pleasant, respectful young boy. Very courteous and helpful toward his classmate, a little girl in a wheelchair, he got her books out of the desk, sharpened her pencil and brought her juice at recess during the observation periods. Table 8 portrays functional abilities in profile (see also Appendix C).

During week one, he worked hard to achieve success when working on his assignments. Each time the nouns appeared on the screen, he attempted to pronounce them correctly. He completed his prescribed assignments in week two without requiring assistance and was permitted to progress to elementary multiplication. In the final week, his word pronunciation appeared to be improving and he could progress reasonably successfully through all the words presented in the noun module. Seeking constant approval for his work, he required continual positive reinforcement.

Table 8

Student Profile I D. 1.1.8

Diagnosis: Expressive language delay

Age: 7 years; Sex: Male
Stanford Binet (IQ): 100

Abilities	Degree of Impairment				
	None	Slight	Moderate	Severe	Total
Vision	normal				
Hearing	normal				
Mobility					
Upper Limbs		gross motor skills			
Lower Limbs		balance			
Physical Health	normal				
Language					
Expression				barely talks*	
Comprehension	normal				
Social/Emotional Function			sharp * fluctuations		
Intellectual Function	normal				

Notes: Therapies: Speech Therapy - daily; Occupational Therapy - three times weekly.

Nursing: Promote constructive use of leadership behavior; discourage immature behaviors.

*Refer to Multidisciplinary Team Appraisal (Appendix C).

Student 1.2.9

Due to this little boy's need for multiple and frequent therapies, his experience in this study was continually interrupted from the outset. The investigator's first impression of this student was that of a delightful, happy, rather chubby lad who was very popular with his peer group. Restricted to a body frame, he was totally physically dependent, therefore requiring books and pencils, etc., to be placed within his reach. During classroom sessions, his attention span seemed to be short, perhaps largely due to his enforced physical immobility. Table 9 presents student profile of functional abilities (see also Appendix C).

A potential difficulty in fitting this child, in his body frame, into the computer room was recognized. This proved to be a real test of adaptability. There was insufficient space to accommodate the frame without creating a fire hazard by blocking the doorway, nor was there room to situate the screen so that it was within his ready visual range when in his necessitated supine position.

During the group orientation, he was enthralled by the capabilities of the computer, eager to learn and well motivated. This level of motivation continued into week two but his attention span decreased appreciably, given the environmental constraints delineated above. He did, however, successfully complete the assignments. This boy missed school completely during the third week of scheduled sessions. During the final week, he was very confident,

Table 9

Student Profile I.D. 1.2.9

Diagnosis: Cerebral Palsy with familial spastic diplegia

Age: 6 years; **Sex:** Male
Stanford Binet (IQ): *

	Degree of Impairment				
Abilities	**None**	**Slight**	**Moderate**	**Severe**	**Total**
Vision		glasses			
Hearing	normal				
Mobility					
Upper Limbs		hypotonicity			
Lower Limbs				dependent	
Physical Health		recurrent infections*			
Language					
Expression				articulation	
Comprehension		lacks reinforcement*			
Social/Emotional Function		cooperative but lacks ** concentration			
Intellectual Function	normal				

Notes: **Therapies:** Physiotherapy - twice daily; Occupational Therapy - weekly; Speech Therapy - biweekly.

Nursing: Transferred from frame to wheelchair twice daily.

[*] No assessment available.

[**] Refer to Multidisciplinary Team Appraisal (Appendix C).

completing sums and differences quickly. He was reasonably able to pronounce each of the nouns presented on the screen. Upon completion of the prescribed assignment, he asked, "Can we {buddy} do some more? We've had our physio . . . ." To try to overcome his difficulties, the teacher agreed to locate one of his sessions at the back of the classroom while the remainder of the group continued with their "regular" learning activities. This, however, proved disruptive to classmates and teacher alike. (Appendix I describes both the positive and negative comments from the teachers' perspectives.)

Student 1.2.10

Upon first observation, this very slow, dull looking little boy was very difficult to understand due to his speech/language delay. He displayed left-handed dominance in all of his classroom assignments and did not attempt to use his right hand. Displaying minor behaviour problems, this child sought attention by becoming teary-eyed when he did not get his own way. The investigator's first observations of this child were probably due to the heavy dose of sedation he was prescribed daily. Table 10 presents student profile of functional abilities (see also Appendix C).

During the first two sessions of the group orientation, this child experienced petit mal seizures while viewing activities on the computer screen in the multicolour mode (the homeroom teacher was unaware that the child had seizures). The colour mode was switched to black-and-white for this child throughout the remaining sessions. No

Table 10

Student Profile I.D. 1.2.10

Diagnosis: Moderate right hemiparesis, epilepsy, retinopathy

Age: 6 years; **Sex:** Male
Stanford Binet (IQ): 76

Abilities	Degree of Impairment				
	None	Slight	Moderate	Severe	Total
Vision			deteriorating		
Hearing	normal				
Mobility					
Upper Limbs			spastic		
Lower Limbs			spastic		
Physical Health			petit mal seizures		
Language					
Expression				tongue mobility	
Comprehension			listening skills[a]		
Social/Emotional Function			weepy[a] distractable		
Intellectual Function			slow[a]		

Notes: **Therapies:** Physiotherapy - three times weekly; Occupational Therapy - three times weekly; Speech Therapy - biweekly.

Nursing: Safety measures for seizures; needs understanding.

[a] Heavy sedation prescribed to control seizures *may* be primary cause.

further seizures occurred while he was at the computer.[2] When working at the computer he was to be encouraged to use his right hand. Following discussion with his teacher, the investigator decided to work with this child on a one-to-one basis. Although his attention span was rather limited, he completed the prescribed assignments during the second week with very little prompting. He was frequently reminded to use his right hand throughout the second and third weeks. When positive behaviour was observed, he was allowed, at the completion of his assignment, to work for an extra ten minutes on a module of his own choice. He was observed, during the final week, to use his right hand voluntarily, unaided though with great difficulty.

Student 1.2.11

This delightful, very quiet little boy required a firm, but gentle approach with a great deal of reassurance. During first observation, he became very sensitive when firm direction was given by his teacher. He was very slow and functioned with a degree of difficulty when assigned workbook tasks. When the chalkboard was used as a teaching aid, although seated at the front of the class, he appeared to have a visual perception problem. In discussion with the teacher, following his observation, she agreed that he had a visual perception problem.

He was a very popular little boy, who became lively when playing with his peers. Table 11 portrays this student's profiles of functional abilities (see also Appendix C).

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[2] "Some of the children can bring on their own attacks by photic stimulation; they produce a flickering light by hand movement or with the television and appear to derive a compulsive form of pleasure from so doing" (Jolly, 1966, p. 285).

During observation periods this child was observed to have become very quiet and appeared sleepy. Upon questioning by investigator, he complained of a headache; his cerebral shunt (see Appendix C, 1.2.11) appeared tense and bulging. The child was transferred to the Nursing Care Centre for observation and further investigation. (The homeroom teacher was unaware that complications could occur with a shunt.)

During the second week, it became apparent that repetitive drill and practice, presenting one subject at a time, was all that this child could absorb. He was encouraged to use his right hand when operating the keyboard.

Throughout the remaining sessions the drill and practice routine was maintained. He appeared to be able to comprehend addition and subtraction with very low, single digit numbers and recognized only very simple nouns. He did, however, attempt to use his right hand without prompting; this was, for him, a very difficult procedure.

Student 1.2.12

When introducing himself to the investigator, this boy's indistinct speech was very apparent; careful attention was required when listening to him. He was a very bright, enthusiastic and loving little boy, well liked by his peers both in the play and classroom settings. He enjoyed reading, writing, riding on his uncle's motorbike and fishing

Table 11

Student Profile I.D. 1.2.11

Diagnosis: Hydrocephalus; right spastic hemiplegia — **Age:** 6 years; **Sex:** Male — **Stanford Binet (IQ):** 91

	Degree of Impairment				
Abilities	None	Slight	Moderate	Severe	Total
Vision		perception			
Hearing	normal				
Mobility					
Upper Limbs				right[a] hand	
Lower Limbs			right[b] leg		
Physical Health		related to shunt*			
Language					
Expression	well developed				
Comprehension	auditory memory	conceptual understanding			
Social/Emotional Function		manipulative			
Intellectual Function		low average[c]			

Notes: **Therapies:** Physiotherapy - four times weekly; Occupational Therapy - four times weekly.

Nursing: Watch for headaches, drowsiness due to shunt blockage. Requires firm but gentle approach.

[a] Encourage use of right hand.

[b] Balance and gait unsteady.

[c] Difficulty with concepts, particularly with numbers.

* Refer to Multidisciplinary Team Appraisal (Appendix C).

with grandpa at the lake. He was bussed in to school daily from a rural area and appeared very tired at the end of the day. Following consultation with his teacher, it was decided to schedule morning computer sessions for him, rather than in the afternoon with others of Group 2. Table 12 depicts this student's profile of functional abilities (see also Appendix C).

This child was very enthusiastic and motivated during group orientation. He had an inquisitive mind, constantly asking how things worked and why. In the second week he completed all prescribed materials, progressing onto higher level sums, calculating to the level of three digit numbers. He encountered difficulty when working at the computer due to the fact that his legs did not bend and he wore braces. In moving around on his chair, he became very unbalanced. This boy's physical position needed to be changed every 15 minutes for the sake of his comfort. He worked through materials very quickly and progressed to modules of his own choice in the last week. With each success that he achieved, his exuberant excitement and enthusiasm increased. However, as his functional ability rose, his speech became more indistinct. This was assumed to be due to his high level of excitement and consequent lack of concentration on his speech.

Table 12

Student Profile I.D. 1.2.12

Diagnosis: Cerebral Palsy, spastic diplegia secondary to prematurity and anoxia

Age: 5 years; **Sex:** Male
Stanford Binet (IQ): *

Abilities	Degree of Impairment				
	None	Slight	Moderate	Severe	Total
Vision	normal				
Hearing	normal				
Mobility					
Upper Limbs	normal				
Lower Limbs					calipers/ crutches
Physical Health	normal				
Language					
Expression				articulation	
Comprehension	normal				
Social/Emotional Function	above average				
Intellectual Function	above average				

Notes: **Therapies:** Physiotherapy - daily; Speech Therapy - three times weekly; Occupational Therapy - weekly.

Nursing: Assistance with all activities of daily living except feeding.

*No assessment available.

Student 1.2.13

This very friendly little boy, when first observed, was working very slowly but conscientiously on a sums assignment. He could not hold a pencil or write, and used rubber stamps for numerical work and a typewriter for written work. A great degree of difficulty was, however, experienced with both aids. He frequently fell off his chair and often bumped into his desk. This boy enjoyed music, reading and art, including looking at art books and magazines. With great difficulty, he attempted finger painting. Speech was very slow and indistinct and he cried easily if his needs were not anticipated. He was a very sensitive little boy who needed a gentle, reassuring approach. Table 13 portrays this student's profiles of functional abilities (see also Appendix C).

He was delighted and enthralled during the group orientation. Although very slow, he was able to work through the introductory elementary module at the computer. Discussion followed with teacher; the investigator felt that the computer practice sessions for this child should be lengthened, to allow for his slow mechanical functioning. It was felt that a template would not be required for the computer keyboard, as the keys were separated by an approximate 1 cm. space; this assessment was confirmed during his first practice session as no difficulty was encountered. In the second week he had a perfect score in both sums and nouns. Due to his slowness, the prescribed differences assignment

Table 13

Student Profile I.D. 1.2.13

Diagnosis: Cerebral Palsy with spastic diplegia and athetosis; convulsive disorder

Age: 7 years; **Sex:** Male
Stanford Binet (IQ): *

Abilities	Degree of Impairment				
	None	Slight	Moderate	Severe	Total
Vision		squint			
Hearing	normal				
Mobility					
Upper Limbs				minimal fine coordination	
Lower Limbs				spastic	
Physical Health		seizures controlled			
Language					
Expression				articulation	
Comprehension	normal				
Social/Emotional Function			frustration		
Intellectual Function	normal				

Notes: **Therapies:** Occupational Therapy - three times weekly; Speech Therapy - three times weekly.

Nursing: Requires assistance for activities of daily living. Wears helmet for head protection; frequent falls.

*No assessment available.

could not be extended. No further extension of time could be given for practice sessions as it would interfere with classroom requirements. He continued his slow, conscientious progress and during the last week was able to complete all of the prescribed assignments.

Student 1.2.14

Upon first observation, this very pretty, but sad looking little girl appeared extremely withdrawn and preoccupied. She rarely smiled, had a short attention span and vascilated back and forth between withdrawn preoccupation and a continual physical movement attention seeking behaviour. She demonstrated marked weakness in written work, and was very untidy, almost illegible at times. She did not relate to her peers in play or in the classroom, preferring to isolate herself whenever possible; e.g. she would sit, preoccupied, under the desk during classroom activities. This little girl did not relate to her teacher and displayed very stubborn behaviour when approached. She required firm, very gentle and reassuring guidance. During this first observation period by the investigator, a psychologist was also present in the classroom, observing this child. Table 14 presents this student's profile of functional abilities (see also Appendix C).

She responded with affection toward the puppet during the group orientation and, although very reluctant at first, she did work through parts of the elementary

Table 14

Student Profile I.D. 1.2.14

Diagnosis: Cerebral Palsy, hypotonia; right convergent strabismus

Age: 5 years; Sex: Female
Stanford Binet (IQ): 105

Activities	Degree of Impairment				
	None	Slight	Moderate	Severe	Total
Vision		right squint			
Hearing	normal				
Mobility					
Upper Limbs		flaccidity			
Lower Limbs		flaccidity			
Physical Health	normal				
Language					
Expression			articulation		
Comprehension	poor listener*				
Social/Emotional Function				abused*	
Intellectual Function	at times not demonstrated*				

Notes: **Therapies:** Speech Therapy - daily; Psychotherapy - daily; Occupational Therapy - daily.

Nursing: Aggressive behavior; elopes. Battered child.

*Refer to Multidisciplinary Team Appraisal (Appendix C).

introductory module on the computer. She had very quiet, indistinct speech in verbally responding to questioning. The investigator was requested, by the psychologist and teacher, to let this child work at the computer only as a reward as part of a behaviour modification program. This request was denied by the investigator; the rationale and decision were supported by the school principal and study supervisor. Attention seeking behaviour was very marked during the second week, although she reluctantly did complete the prescribed assignment. During the third week, continual prompting was required with assignments. It was apparent that she did not want to continue, and was very tired and upset. Allowed to stop working on her assignment, she wandered around touching and examining the investigator's purse and briefcase. In the final week, she displayed only a mild degree of interest in the activities around her.

Student 1.2.15

This child was observed to be a very physically dependent little girl who required all her classroom materials placed directly in front of her. She required a special desk in the classroom, so that her total body contact "cart" could fit under it. She was a highly motivated child who learned new material very quickly. Well liked by her peers, she displayed leadership abilities with any group activity. She liked to "run the show." Table 15 presents this student's profile of functional abilities (see also Appendix C).

Table 15

Student Profile I.D. 1.2.15

Diagnosis: Werdnig-Hoffman syndrome; muscular dystrophy

Age: 6 years; Sex: Female
Stanford Binet (IQ): 89*

Abilities	Degree of Impairment				
	None	Slight	Moderate	Severe	Total
Vision	normal				
Hearing	normal				
Mobility					
Upper Limbs				slight wrist joint movement	
Lower Limbs					none
Physical Health				terminal**	
Language					
Expression	excellent				
Comprehension	normal				
Social/Emotional Function	above average				
Intellectual Function	bright				

Notes: Therapies: Physiotherapy - as required; Occupational Therapy - daily.
Nursing: Total care.

*Assessed at age 5, no current assessment available.

**Refer to Multidisciplinary Team Appraisal (Appendix C).

During the group orientation period, this little girl displayed attention seeking behaviour and became very demanding of the teacher, investigator and peers. Difficulty was encountered in positioning the computer keyboard within her reach. Once this was achieved, she could not see the screen due to her restrictive head movement and body brace. Once repositioned and reasonably situated so that she could use the computer, she became very enthusiastic, however her limited hand movement resulted in very slow progression through the assignment. At times she became verbally agressive and frustrated.

In the second week, she succeeded in working through sums and differences with an excellent achievement score. During a recess period she asked for permission to work on the computer; this was granted. The last session was not completed due to the rapid deterioration in her physical condition, resulting in her admission to an acute care hospital intensive care unit. Her "well done" certificate (see Appendix H) was given to her in hospital by her father, who had contacted the investigator because of her concerns in missing the final party and presentation of certificates.

Student 1.2.16

During the first classroom observation, this little boy was noted to have a very limited attention span. He was frequently under the desk and quietly laying on the floor. Usually, he was observed as a shy, smiling and delightful child who played well with his peers, however he became physically aggressive when he did not get his own way. Requiring reassurance and gentle understanding, he displayed difficulty in the areas of expressive language and grammar. Table 16 portrays this student's profile of functional abilities (see also Appendix C).

This boy played happily with the puppet during periods of group orientation. He appeared to have difficulty with hand-eye coordination when working at the computer, but was very enthusiastic in his work, especially when this was reinforced by a musical response from the computer for a correct score. Although he required a substantial amount of prompting and assistance with sums and differences during the second week, he was much more confident. with the noun assignment. His degree of confidence in his own ability appeared to grow in the subsequent sessions.

Though he still required assistance and prompting with assignments, he was not deterred from requesting extra computer time during his lunch breaks. This was granted.

Pre-, Post- and Retention Tests

The educational curricular concepts used as a basis for the individual students' orientation to computer assisted instruction were sums, differences and nouns. The former two concepts were deemed by the teachers to be familiar to the students; the latter was a new concept, planned to be introduced later in the regular curriculum plan.

Table 16

Student Profile I.D. 1.2.16

Diagnosis: Speech and language delay

Age: 6 years; Sex: Male
Stanford Binet (IQ): 99

	Degree of Impairment				
Abilities	None	Slight	Moderate	Severe	Total
Vision	normal				
Hearing	normal				
Mobility					
Upper Limbs	normal				
Lower Limbs	normal				
Physical Health		malnourished			
Language					
Expression		articulation			
Comprehension			inferential reasoning		
Social/Emotional Function	tries to please				
Intellectual Function	bright				

Notes: Therapies: Speech Therapy - four times weekly.
Nursing: Child battering suspected.

As has been emphasized throughout, the primary objective of this investigation was to orient a heterogeneous sample of physically handicapped Grade 1 students to computer assisted instruction as a teaching methodology. Therefore, measures to assess whether or not the concepts addressed had been learned (testing) have been somewhat de-emphasized. Tests are, however, utilized as a standard method by which a teacher appraises a student's knowledge. Thus, pre-, post- and retention tests were deemed an appropriate activity to have the children undertake in this investigation.

Sums

The students' pretest, posttest and retention test scores for sums are presented in Table 17, expressed in percentages. The mean score for the pretest is high--86.4 percent. An almost perfect (98.6%) mean score was achieved in the retention test. These results would appear to confirm that sums were indeed a familiar concept to the students but that general improvement was demonstrated.

Differences

Table 18 records the students' pre-, post- and retention test scores in differences. A review of the scores achieved would, again, suggest that the concept of differences was not entirely new to the students. The pretest mean results being 65.9 percent, it would appear that the students were less familiar with differences than they were

Table 17

Sums Achievement Scores

Student	Pretest[a] %	Post-test[a] %	Retention Test[b] %
Group 1			
1.1.1	100	100	---[c]
1.1.2	100	100	100
1.1.3	100	100	90
1.1.4	100	100	100
1.1.5	100	100	100
1.1.6	83	100	100
1.1.7	100	100	100
1.1.8	83	100	100
Group 2			
1.2.9	83	100	90
1.2.10	67	83	100
1.2.11	67	83	100
1.2.12	100	100	100
1.2.13	83	100	100
1.2.14	50	67	100
1.2.15	100	100	---[c]
1.2.16	67	100	100
Mean Scores	86.4%	95.8%	98.6%

[a] Paper/pencil test, repeated (see Appendix E).

[b] Computer assisted instruction test.

[c] Not available for testing.

Table 18

Differences Achievement Scores

Student	Pretest[a] (%)	Post-test[a] (%)	Retention Test[b] (%)
Group 1			
1.1.1	88	100	---[c]
1.1.2	100	100	100
1.1.3	88	100	90
1.1.4	88	100	100
1.1.5	100	100	100
1.1.6	100	100	100
1.1.7	63	88	100
1.1.8	100	100	100
Group 2			
1.2.9	50	100	80
1.2.10	13	25	90
1.2.11	38	50	40
1.2.12	75	88	100
1.2.13	13	38	80
1.2.14	38	25	100
1.2.15	75	75	---[c]
1.2.16	25	88	80
Mean Scores	65.9%	79.8%	90.0%

[a] Paper/pencil test, repeated (see Appendix E).

[b] Computer assisted instruction test.

[c] Not available for testing.

with sums at this stage. Overall improvement seemed apparent in the posttest and retention test scores. These assumptions were affirmed by the teachers.

Nouns

Upon recommendation of the teachers, nouns were introduced as a new concept from an instructional perspective. That is, these teachers had not yet introduced this concept into their regular classroom instruction and would not do so for the duration of this study. Table 19 depicts the pre-, post- and retention test results for nouns. The relatively low (54.7%) mean score results of the pretest were, as indicated above, to be expected. Again, progress appears to have been demonstrated in the 78.6 percent mean score achieved for the retention test.

With the context of this study, the investigator has not attempted to draw any conclusions as to whether (or not) these results could be an indicator that learning has occurred. Indeed, if no further learning occurred, but individual students were merely better able to demonstrate their knowledge through the computer assisted instructional mode, this would enhance the apparent effectiveness of this technology. At the conclusion of this study, the teachers involved submitted written comments on their observations (see Appendix I).

Table 19

Nouns Achievement Scores

Student	Pretest[a] (%)	Post-test[a] (%)	Retention Test[b] (%)
Group 1			
1.1.1	75	100	---[c]
1.1.2	25	25	100
1.1.3	50	100	60
1.1.4	50	75	50
1.1.5	50	75	100
1.1.6	75	75	90
1.1.7	100	100	100
1.1.8	75	100	100
Group 2			
1.2.9	50	50	90
1.2.10	50	75	50
1.2.11	0	0	20
1.2.12	100	100	90
1.2.13	50	0	90
1.2.14	50	0	90
1.2.15	25	50	---[c]
1.2.16	50	100	70
Mean Scores	54.7%	64.1%	78.6%

[a] Paper/pencil test, repeated (see Appendix E).

[b] Computer assisted instruction test.

[c] Not available for testing.

Summary

The implementation phase of this investigation has been described in detail in terms of the overall study, as well as in terms of anecdotal observations of each individual child's progress. Activities for group orientation to computer assisted instruction included introduction of a puppet, current "Speak and Spell" and digital calculation teaching aids, chalk board, posters and a "homework" colouring assignment.

The students' specific orientation to computer assisted instruction involved two, one-half hour sessions per week for four weeks, during which each child worked with the microcomputer on prescribed assignments.

Content for the computer assisted instruction included sums, differences and nouns.

Pre- and posttests were administered and completed in the pencil/paper mode. Retention tests were presented via the microcomputer mode during the seventh week of the study. Content for the pre- and posttests were identical, with equivalent material tested via computer mode in the retention test. Results of the testing were reported (see Tables 17, 18 and 19).

Given the wide variance in physical handicaps among the students selected for the study, specific observations regarding student-computer interface are reported in each of the anecdotal analyses.

CHAPTER V

CONCLUSIONS AND RECOMMENDATIONS

The primary intent of this study was to orient sixteen physically handicapped Grade one students to the physical operation of a microcomputer for the purpose of utilizing simple drill and practice computer assisted instruction.

Initial evaluative conclusions indicate that:

1. Using innovative methods, all sixteen physically handicapped children in this study were indeed able to become familiar with the microcomputer;
2. Of the sixteen students, only three were so severely handicapped that they were unable to functionally operate the equipment and these three were able to direct others to do so in their behalf; and
3. Using the microcomputer, each child was able to demonstrate his or her knowledge in prescribed assignments of previously learned and new concepts selected by their teachers as being appropriate to the Grade one level of learning.

There were several unanticipated gains from this study. The potential merits of computer assisted instruction as an adjunct to multidisciplinary therapies required by physically handicapped children, as well as to education, was recognized. Regardless of their handicaps, these children were enthusiastically motivated and, within the limitations of this study, each demonstrated progress toward the individualized goals established for them within the school.

For the investigator, there was a personal professional gain. Coming from a background of nurse-educator specializing in paediatric illnesses, this was her first opportunity to affirm a previously held belief that her professional knowledge, skills and attitudes were equally applicable to well children in a non-hospital setting. There is no difference--children are children.

As this was a limited, descriptive study, there was no intent to achieve conclusive findings. There does, however, appear to be sufficient indication that in-depth experimental research into the applications of computer assisted instruction for physically handicapped children with a primary objective of minimizing effects of the handicaps could yield positive results. If this is to be pursued, the following recommendations are offered:

1. A current, wholistic profile of each student's needs must be maintained and made accessible to all professional staff, regardless of discipline (as well as future researchers) who have reason to interact with the student.
2. Effective collaborative communication between members of all disciplines is essential if the multidisciplinary team concept is to be a reality.

3. In any future research involving computer technology and physically handicapped individuals, it is imperative that consideration be given to allocation of an appropriate environment; and, if such research involves four or more students, it is desirable to have more than one terminal available for use.
4. Further investigation of computer technology and its application to prevocational and vocational education for physically handicapped individuals is warranted.
5. It is imperative that research be conducted to examine the relationship between visual acuity and video screen usage.

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APPENDIX A

SUMMARY OF
MULTIDISCIPLINARY TEAM APPRAISAL - INSTRUMENT

Diagnosis: ______________________

Identification: ________
Admission Date: ________
Birth Date: ____________
Sex: ___________________

SUMMARY OF MULTIDISCIPLINARY TEAM APPRAISAL

Department	Relevant Data from Cumulative Records as of 1979-09
Medicine:	
Education:	
Physiotherapy:	
Occupational Therapy:	
Speech Therapy/Audiology:	
Psychology:	
Social Services:	
Nursing:	

____

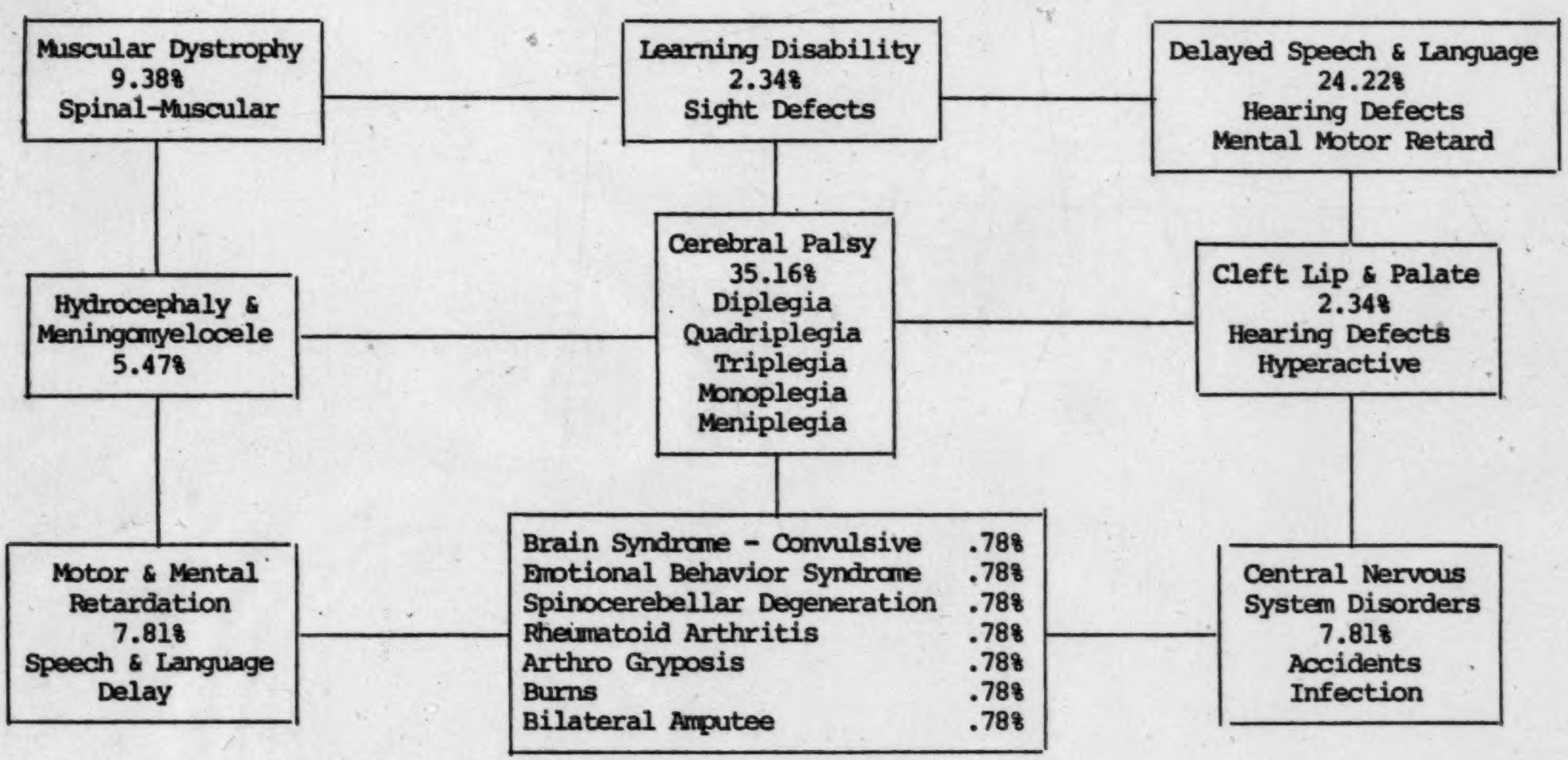
APPENDIX B

GLENROSE SCHOOL HOSPITAL POPULATION PROFILE: KINDERGARTEN - GRADE 12

Glenrose School Hospital Population Profile: Kindergarten - Grade 12

(N = 128)

(Compiled from the medical classification in each student's file)


Muscular Dystrophy
9.38%
Spinal-Muscular
Learning Disability
2.34%
Sight Defects
Delayed Speech & Language
24.22%
Hearing Defects
Mental Motor Retard
Hydrocephaly &
Meningomyelocele
5.47%
Cerebral Palsy
35.16%
Diplegia
Quadriplegia
Triplegia
Monoplegia
Meniplegia
Cleft Lip & Palate
2.34%
Hearing Defects
Hyperactive
Motor & Mental
Retardation
7.81%
Speech & Language
Delay
Brain Syndrome - Convulsive .78%
Emotional Behavior Syndrome .78%
Spinocerebellar Degeneration .78%
Rheumatoid Arthritis .78%
Arthro Gryposis .78%
Burns .78%
Bilateral Amputee .78%
Central Nervous
System Disorders
7.81%
Accidents
Infection

APPENDIX C

MULTIDISCIPLINARY APPRAISAL OF EACH STUDENT IN SAMPLE

SUMMARY OF MULTIDISCIPLINARY TEAM APPRAISAL

Diagnosis: Sensorineural hearing loss with secondary language delay

Identification: 1.1.1
Admission Date: 1979-09
Birth Date: 1972-12-02
Sex: Female

Department	Relevant Data from Cumulative Records as of 1979-09
Medicine	- birth history not available (born in northern Canada) - Meningococcal Meningitis at age 8 months resulting in severe hearing loss and language delay
Education	- Stanford Binet (IQ): 113 - strong motivation to learn - superior mental abilities - excellent work habits - very shy child - long-term goal to attend school in Northwest Territories
Physiotherapy	- well developed fine motor skills - right-handed preference - weak left eye preference - normal neuromuscular maturation
Speech Therapy/ Audiology	- daily speech therapy - daily vocabulary and articulation therapy - marked receptive and expressive language delay - hearing loss: -complete in left ear -partial in right ear - wears hearing aid
Social Services	- Eskimo child, living with foster parents in Edmonton - spends summer holidays with parents in Northwest Territories - excellent relationship between natural, foster parents, and child
Nursing	- check hearing aid is being worn

Note: Grade level achievement 1980-06-30: Reading 1.9; Language 1.8; Arithmetic 2.1; Spelling 2.1; Environmental 1.8; Printing 2.2; Art 2.0; and Music 2.0.

Discharged to Hard of Hearing Program, Alberta School for the Deaf, Edmonton.

SUMMARY OF MULTIDISCIPLINARY TEAM APPRAISAL

Diagnosis: Hyperactive behavior syndrome with delayed speech and language

Identification: 1.1.2
Admission Date: 1979-09
Birth Date: 1973-01-22
Sex: Male

Department	Relevant Data from Cumulative Records as of 1979-09
Medicine	- birth history not available (born in Thailand)
Education	- Stanford Binet (IQ): 117 - intellectual ability in normal range; bright - long-term goal to attend regular school in 1980
Speech Therapy/ Audiology	- intensive daily speech therapy - long-term goals to: a) develop auditory memory and skills b) develop vocabulary articulation skills to age level
Psychology	- group therapy to develop socialization skills
Social Services	- lives with parents - mother speaks Thai, no English - father speaks English, very little Thai - only father involved in child's education
Nursing	- can be aggressive with peers if he cannot control situation - displays certain anxiety patterns

---

Note: Grade level achievement 1980-06-30: Reading 1.8; Language 1.9; Arithmetic 2.1; Spelling 2.0; Environmental 1.9; Printing 1.9; Art 2.0; Music 2.0.

Discharged to attend Grade 2 in regular school.

SUMMARY OF MULTIDISCIPLINARY TEAM APPRAISAL

Diagnosis: Birth trauma resulting in Cerebral Palsy with spastic quadriplegia	**Identification:** 1.1.3 **Admission Date:** 1979-09 **Birth Date:** 1973-02-04 **Sex:** Female

Department	Relevant Data from Cumulative Records as of 1979-09
Medicine	Birth history: - mother received intramuscular meperidine 45 minutes prior to delivery - "flat" at birth - Apgar: 3-5 - anoxia, resulting in left spastic hemiparesis
Education	- Stanford Binet (IQ): no current assessment - bright, attractive, motivated - requires assistance with written work - long-term goal to attend regular school in 1980
Physiotherapy	- daily therapy - gait very unsteady - grasp, fine control in left hand very limited - paralysis, left extremities - spasticity in left arm limits functions
Occupational Therapy	- therapy twice weekly - learning typing skills - developing fine major and registration (pencil) skills - requires visual perception stimulation
Social Services	- lives at home with parents - both parents fully involved in education, love, caring
Nursing	- requires assistance with activities of daily living

---

Note: Grade level achievement 1980-06-30: Reading 2.0; Language 2.1; Arithmetic 2.0; Spelling 1.9; Environment 2.1; Printing 1.8; Art 1.7; Music 2.0.

Remained at G.S.H. for Grade 2.

SUMMARY OF MULTIDISCIPLINARY TEAM APPRAISAL

Diagnosis: Delayed speech and language, behavior problem

Identification: 1.1.4
Admission Date: 1979-09
Birth Date: 1972-06-28
Sex: Female

Department	Relevant Data from Cumulative Records as of 1979-09
Medicine	Birth history: -(born in Hong Kong) - cord around neck, possible anoxia
Education	- Stanford Binet (IQ): 83 - very shy, quiet child - will talk and sing while playing games - long-term goal not yet determined
Occupational Therapy	- therapy twice weekly - hypertonicity - coordination of gross motor skills - socialization experiences
Speech Therapy/ Audiology	- speech therapy four times a week - little spontaneous speech, must be prompted into talking and doing - very little English spoken at home
Social Services	- Chinese family, three siblings - father killed in car accident one year after immigration to Canada - mother attending "English as a Second Language" classes at Alberta Vocational Centre - little family socialization with Chinese community
Nursing	- frequent upper respiratory tract infections - tonsillectomy planned

---

Note: Grade level achievement 1980-06-30: Reading 1.9; Language 1.8; Arithmetic 2.0; Spelling 2.0; Environment 1.7; Printing 2.0; Art 2.0; Music 2.0.

Remained at G.S.H. for Grade 2.

SUMMARY OF MULTIDISCIPLINARY TEAM APPRAISAL

Diagnosis: Severe speech and language delay; hyperactive behavior syndrome

Identification: 1.1.5
Admission Date: 1979-09
Birth Date: 1972-08-03
Sex: Male

Department	Relevant Data from Cumulative Records as of 1979-09
Medicine	Birth History: - mother received intramuscular meperidine one hour prior to breech delivery - Apgar: 7-10 - persistent peripheral cyanosis at birth - incubator for first twenty-four hours
Education	- Stanford Binet (IQ): 69 - high level of comprehension and knowledge, especially with numbers - learns quickly - skill levels higher than other children in class - long-term goal not yet determined
Occupational Therapy	- therapy twice weekly - improve gross motor and usual perception skills (balance, ball skills) - social behavior and peer interaction
Speech Therapy/ Audiology	- intensive speech therapy four times weekly - vowel sounds, articulation and pronunciation
Psychology	- group therapy three times weekly - extensive therapy in behavior management
Social Services	- lives at home with (Greek) parents - father is an invalid - mother works - therefore parents not readily available re academic needs
Nursing	- medication program for control of hyperactive behavior

---

Note: Grade level achievement 1980-06-30: Reading 2.0; Language 1.8; Arithmetic 2.5; Spelling 2.2; Environment 1.7; Printing 2.0; Art 1.6; Music 1.8.

Remained at G.S.H. for Grade 2.

SUMMARY OF MULTIDISCIPLINARY TEAM APPRAISAL

Diagnosis: Motor/mental developmental retardation, convulsive disorder, delayed speech and language

Identification: 1.1.6
Admission Date: 1979-09
Birth Date: 1973-11-10
Sex: Male

Department	Relevant Data from Cumulative Records as of 1979-09
Medicine	Birth History (born in South Africa) - difficult delivery, details unknown - myoclonic seizures, etiology unknown
Education	- Stanford Binet (IQ): 68 - considered to be educable - timid, shy little boy - long-term goal to attend regular school in 1980
Occupational Therapy	- biweekly therapy - involvement with gross motor development - tactile defensiveness - socialization programs
Speech Therapy/ Audiology	- weekly therapy - some difficulty with auditory processing (vocabulary and discrimination)
Social Services	- lives with (East Indian) parents recently required to leave South Africa - coping with change in social status, culture
Nursing	- dependent on direction from others for activities of daily living, e.g. toileting - limited fluency in self-expression - requires protective safety measures re convulsive disorder/myoclonic seizures

---

Note: Grade level achievement 1980-06-30: Reading 2.2; Language 2.0; Arithmetic 2.0; Spelling 2.7; Environmental 1.9; Printing 1.8; Art 1.8; Music 2.0.

Discharged to attend Grade 2 in regular school.

SUMMARY OF MULTIDISCIPLINARY TEAM APPRAISAL

Diagnosis: Speech and language delay; elective mutism

Identification: 1.1.7
Admission Date: 1979-09
Birth Date: 1972-08-17
Sex: Male

Department	Relevant Data from Cumulative Records as of 1979-09
Medicine	Birth History: - mother received intramuscular meperidine 3.3 hours prior to delivery - Apgar: 5-8 - poor response to stimuli
Education	- Stanford Binet (IQ): 88 - appears to enjoy learning - has great difficulty expressing his joy - long-term goal to attend regular school
Occupational Therapy	- twice weekly therapy - group therapy for social awareness
Speech Therapy/ Audiology	- twice weekly therapy - delayed receptive language - severe articulation disorder
Psychology	- intensive one-to-one and small-group therapy three times a week - tends to be a loner, prefers solitary play - very withdrawn
Social Services	- lives at home with parents - parents very demanding, placing high expectations on his achievements and abilities
Nursing	- very teary-eyed little boy; needs gentle, supportive approach - withdraws when confronted directly - needs must be anticipated; he will not vocalize them

---

Note: Grade level achievement 1980-06-30: Reading 1.9; Language 1.6; Arithmetic 2.0; Spelling 2.2; Environmental 1.8; Printing 2.1; Art 2.0; Music 1.9.

Discharged to attend Grade 2 in regular school.

SUMMARY OF MULTIDISCIPLINARY TEAM APPRAISAL

Diagnosis: Expressive language delay

Identification: 1.1.8
Admission Date: 1979-09
Birth Date: 1972-08-11
Sex: Male

Department	Relevant Data from Cumulative Records as of 1979-09
Medicine	Birth History: - mother received intramuscular meperidine one hour prior to mid-forceps delivery - Apgar; 8-10
Education	- Stanford Binet (IQ): 100 - well motivated to learning - displays inappropriate behavior when excited - long-term goal to attend regular school
Occupational Therapy	- therapy three times weekly - coordinate of gross motor skills when excited - improve balance - modify immature behavior
Speech Therapy/ Audiology	- daily therapy - improve expressive language - small jaw; questionable tongue movement
Social Services	- lives at home with parents
Nursing	- tall, well built, looks older than his age - often assumes leadership roles among peers to gain acceptance, a quality which (with supervision and guidance) could be utilized constructively

---

Note: Grade level achievement 1980-06-30: Reading 2.0; Language 1.7; Arithmetic 2.2; Spelling 1.9; Environmental 1.7; Printing 1.8; Art 1.7; Music 2.0.

Discharged to attend Grade 2 in regular school.

SUMMARY OF MULTIDISCIPLINARY TEAM APPRAISAL

Diagnosis: Cerebral Palsy with familial spastic diplegia

Identification: 1.2.9
Admission Date: 1979-09
Birth Date: 1973-03-13
Sex: Male

Department	Relevant Data from Cumulative Records as of 1979-09
Medicine	- birth history not available (born in Canada) - third handicapped child in this family - recent surgery on legs and ankles
Education	- Stanford Binet (IQ): no current assessment - cooperative in classroom - has difficulty getting down to work - long-term goal to complete academic program at G.S.H.
Physiotherapy	- intensive, twice daily therapy - extensive leg muscle exercises - gross and fine motor coordination - bilateral leg braces - uses wheeled frame or wheelchair
Occupational Therapy	- weekly therapy - small group interaction, socialization program
Speech Therapy/ Audiology	- biweekly therapy - delayed speech and language - articulation defect, pronounced stutter
Social Services	- lives with loving (Metis) parents and siblings - father is an alcoholic - no bath in home; poor hygiene - poor home environment
Nursing	- requires assistance in all activities of daily living - special diet for weight control - special hygiene requirements due to home environment - transferred from frame to wheelchair twice daily

---

Note: Grade level achievement 1980-06-30: Environment 1.6; Mathematics 1.9; Letters & Sounds 1.5; Oral Comprehension 1.4; Word Reading 1.8; Sentence Reading 1.6.

Remained at G.S.H. for Grade 2.

SUMMARY OF MULTIDISCIPLINARY TEAM APPRAISAL

Diagnosis: Moderate right hemiparesis, epilepsy, retinopathy

Identification: 1.2.10
Admission Date: 1979-09
Birth Date: 1973-02-27
Sex: Male

Department	Relevant Data from Cumulative Records as of 1979-09
Medicine	Birth History: limited information available (adopted at age 5 weeks) - questionable Rubella Syndrome - etiology of diagnosis uncertain
Education	- Stanford Binet (IQ): 76 - learns well in highly structured situations - distractable, concentration difficulty - long-term goal to remain at G.S.H.
Physiotherapy	- therapy three times weekly - wears orthopaedic boots - very uncoordinated gait
Occupational Therapy	- therapy three times weekly - encourage use of right hand and arm to develop fine motor skills - delayed visual-motor integration; hand-eye coordination encouraged
Speech Therapy/ Audiology	- therapy biweekly - severe difficulty with articulation, poor tongue mobility - improve listening skills
Social Services	- lives at home with parents and sibling - father a member of armed forces, employment mobility raises concerns for child's educational placement
Nursing	- has petit mal seizures; medication prescribed - when rushed or excited, tends to fall due to unsteady gait - encourage use of right hand when playing, eating

---

Note: Grade level achievement 1980-06-30: Environment 1.4; Mathematics 1.3; Letters & Sounds 1.4; Oral Comprehension 1.2; Word Reading 1.5; Sentence Reading 1.5.

Remained at G.S.H. for special program.

SUMMARY OF MULTIDISCIPLINARY TEAM APPRAISAL

Diagnosis: Extreme prematurity; communicating hydrocephalus with gross dilation of the lateral ventricles; right spastic hemiplegia

Identification: 1.2.11
Admission Date: 1979-09
Birth Date: 1973-02-04
Sex: Male

Department	Relevant Data from Cumulative Records as of 1979-09
Medicine	Birth History: - extreme prematurity (27-28 weeks gestation) - respiratory distress syndrome at birth Right ventricular-atrial shunt inserted 1973-07-27 - five subsequent revisions; one replacement - prognosis: probable severe brain damage
Education	- Stanford Binet (IQ): 91 - low average intellectual function - good auditory memory - difficulty with number concepts - behind in school work - long-term goal to attend regular school in 1980
Physiotherapy	- therapy four times weekly - minimal difficulty with balance, gait, fine motor skills - limited use of right hand - (1980-01-21): "Voluntary movement of right hand--is able to extend fingers ... but is unable to maintain fingers in extension for more than a second. He is unable to actively extend his wrist but can pick up objects with wrist extended with moderate degree of difficulty..." (Rehabilitation Medicine, 1980).
Occupational Therapy	- therapy four times weekly - emphasis on use of right hand, fine motor skills - moderate difficulty in conceptual understanding

(cont'd...)

Identification: 1.2.11 (cont'd)

Department	Relevant Data from Cumulative Records as of 1979-09
Speech Therapy/ Audiology	- verbal fluency well developed; speech had been delayed
Psychology	- 1975 appraisal: mentally defective range of ability - 1979 appraisal: average intellectual potential - many preacademic skills necessary for grade 1
Nursing	- manipulative behavior, will get peers to do things he can do for himself

---

Note: Grade level achievement 1980-06-30: Environment 1.9; Mathematics 1.2; Letters & Sounds 1.4; Oral Comprehension 1.4; Word Reading 1.4; Sentence Reading 1.2.

Discharged to attend Grade 1 in regular school.

SUMMARY OF MULTIDISCIPLINARY TEAM APPRAISAL

Diagnosis:	Cerebral Palsy, spastic diplegia secondary to prematurity and anoxia	Identification:	1.2.12
		Admission Date:	1979-09
		Birth Date:	1974-01-03
		Sex:	Male

Department	Relevant Data from Cumulative Records as of 1979-09
Medicine	Birth History: - premature, 32 weeks gestation, 3 pounds birth weight - foetal distress, heart beat absent during first and second stages of labor - respiratory distress syndrome - acute gastroententis at 3 days of age - developmental lag due to prematurity and illness at birth
Education	- Stanford Binet (IQ): no assessment available - above average ability - highly motivated - long-term goal to attend regular school in 1980
Physiotherapy	- therapy daily - wears calipers, orthopaedic boots both legs; elbow crutches - develop gross motor coordination, balance and gait
Occupational Therapy	- therapy weekly - fine motor and perceptual difficulties - small group play
Speech Therapy/ Audiology	- therapy three times weekly - articulation problems; lateral lisp
Social Services	- lives at home with parents and sibling - very supportive family environment
Nursing	- requires assistance with toileting

Note: Grade level achievement 1980-06-30: Environment 1.5; Mathematics 2.3; Letters & Sound 2.0; Oral Comprehension 1.4; Word Reading 1.9; Sentence Reading 1.6.

Discharged to attend Grade 2 in regular school.

SUMMARY OF MULTIDISCIPLINARY TEAM APPRAISAL

Diagnosis:	Cerebral Palsy with spastic diplegia and athetosis; convulsive disorder	Identification:	1.2.13
		Admission Date:	1979-09
		Birth Date:	1972-04-05
		Sex:	Male

Department	Relevant Data from Cumulative Records as of 1979-09
Medicine	Birth History: - abruptio placenta, premature forceps delivery (36 weeks gestation) - neonatal asphyxia; intubated and aspirated at birth - depressed central nervous system; hypotonic; no sucking reflex; high pitched cry - neonatal convulsions, aged 3 days
Education	- Stanford Binet (IQ): no assessment mental age - 8 years - average intellectual potential - cannot hold pencil to write - long-term goal to attend regular school
Physiotherapy	- poor gross motor coordination - falls frequently; wears helmet to protect head
Occupational Therapy	- therapy three times weekly - visual/motor problems; weak fine motor skills - uses typewriter with keyboard template for written work - uses rubber stamps for numerical work
Speech Therapy/ Audiology	- therapy three times weekly - moderate articulation, expressive language problems
Social Services	- lives at home with parents and sibling - supportive environment
Nursing	- convulsive disorder currently controlled by medication - requires assistance with activities of daily living

---

Note: Grade level achievement 1980-06-30: Environment 1.7; Mathematics 1.3; Letters & Sound 1.5; Oral Comprehension 1.8; Word Reading 1.5; Sentence Reading 1.7.

Remained at G.S.H. for Grade 2.

SUMMARY OF MULTIDISCIPLINARY TEAM APPRAISAL

Diagnosis: Cerebral Palsy, hypotonia; right convergent strabismus; delayed motor and mental development; (?)moderate speech and language disorder

Identification: 1.2.14
Admission Date: 1979-09
Birth Date: 1973-12-21
Sex: Female

Department	Relevant Data from Cumulative Records as of 1979-09
Medicine	Birth History: - intoxicated mother received valium 10 minutes prior to difficult face presentation delivery (three cord vessels present) - Apgar: 3-7 - resuscitation required at birth; left pneumothorax; no femoral pulse - anterior fontanel 2 x 2 cm; baby hypoactive
Education	- Stanford Binet (IQ): 105 - strong leadership qualities - long-term goal to remain at G.S.H. in 1980
Occupational Therapy	- small-group interaction program - social work group to improve socialization
Speech Therapy/ Audiology	- daily therapy - articulation and expressive language problems - poor listening skills
Psychology	- daily individualized therapy, including play - low self-esteem - negative, sulky behavior; poor peer interaction - runs away from school, home - behavior modification program in classroom
Social Services	- (Metis) lives in foster home with sibling since age 5 months*

(cont'd...)

Identification: 1.2.14 (cont'd)

Department	Relevant Data from Cumulative Records as of 1979-09
Nursing	- very aggressive towards peers; self-destructive - strikes out at other children, takes their things - requires close observation when not in classroom; elopes

---

Note: Grade level achievement 1980-06-30: Environment, Mathematics, Letters & Sounds, Oral Comprehension, Word Reading and Sentence Reading--no grade level assigned by teacher.

Remained at G.S.H. to continue Grade 1.

*1980- 02- battering reported by school teacher; removed from foster home and placed in institution with sister.

SUMMARY OF MULTIDISCIPLINARY TEAM APPRAISAL

Diagnosis:	Werdnig-Hoffman syndrome; muscular dystrophy

Identification:	1.2.15
Admission Date:	1979-09
Birth Date:	1973-04-05
Sex:	Female

Department	Relevant Data from Cumulative Records as of 1979-09
Medicine	Birth History: - fraternal twins, delivered by Caesarean section - Apgar: 6-10 - twins appeared normal at birth; low birth weight, therefore placed in incubator as precaution - both twins now severely handicapped; attending G.S.H.*
Education	- Stanford Binet (IQ): 89 at age 5; average for age - mentally bright - leadership ability - long-term goal to transfer to regular school if possible
Physiotherapy	- therapy as necessitated by progress of disease - Milwaukee brace - total body contact wheelchair (specially designed cart)
Occupational Therapy	- small group therapy to improve communication and community awareness
Social Services	- lives at home with parents and twin - parents moved away from family and friends to move to Edmonton to meet the increasing education of therapeutic needs of their children - family requires support +++
Nursing	- requires assistance with all activities of daily living - requires close observation and attention for frequent discomforts and pressure areas

---

Note: Grade level achievement 1980-06-30: Environment 1.5; Mathematics 2.4; Letters & Sound 1.6; Oral Comprehension 1.6; Word Reading 1.2; Sentence Reading 1.7.

Remained at G.S.H. to continue Grade 1.

* 1980-06, seriously ill, hospitalized; did not complete last two weeks of school term

SUMMARY OF MULTIDISCIPLINARY TEAM APPRAISAL

Diagnosis: Speech and language delay

Identification: 1.2.16
Admission Date: 1979-09
Birth Date: 1973-06-01
Sex: Male

Department	Relevant Data from Cumulative Records as of 1979-09
Medicine	Birth History: - premature (34 weeks) precipitate delivery in ambulance - Apgar: 7-8 - hypoglycaemic at birth
Education	- Stanford Binet (IQ): 99 - bright, very attentive child - well motivated in classroom - long-term goal to attend regular school in 1980
Speech Therapy/ Audiology	- therapy four times weekly - mild articulation, expressive language delay - moderate receptive language delay - difficulty with synthesis and inferential reasoning
Social Services	- lives at home with mother and two siblings - poor home environment; frequently tended by 16 year old sibling - family visited and closely observed by Social Service Worker and Public Health Nurse
Nursing	- Public Health Nurse supervision for hygiene, social care - history of deprivation; child battering suspected

---

Note: Grade level achievement 1980-06-30: Environment 1.7; Mathematics 1.4; Letters and Sounds 1.5; Oral Comprehension 1.5; Word Reading 1.5; Sentence Reading 1.5.

Discharged to attend Grade 2 in regular school. (Teacher recommended Grade 2 at Glenrose; team recommended discharge.)

APPENDIX D

STUDENT PROFILE OF FUNCTIONAL ABILITIES

Student Profile of Fuctional Abilities

Diagnosis:

Age: **Sex:**
Stanford Binet (IQ):

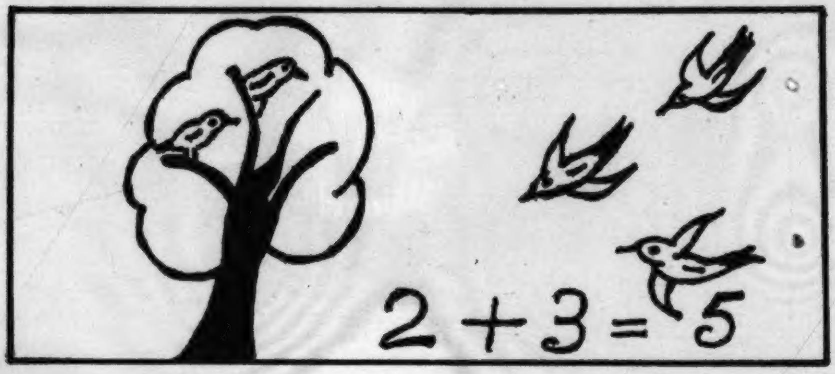
Abilities	Degree of Impairment				
	None	Slight	Moderate	Severe	Total
Vision					
Hearing					
Mobility					
Upper Limbs					
Lower Limbs					
Physical Health					
Language					
Expression					
Comprehension					
Social/Emotional Function					
Intellectual Function					

Notes: **Therapies:**
Nursing:

APPENDIX E

PRE- AND POSTTESTS

ADDITION



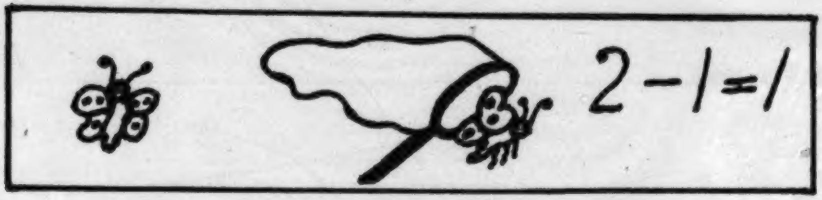
Find the sums.

$$\begin{array}{r} 2 \\ +2 \\ \hline \end{array} \qquad \begin{array}{r} 4 \\ +3 \\ \hline \end{array}$$

$$\begin{array}{r} 5 \\ +0 \\ \hline \end{array} \qquad \begin{array}{r} 7 \\ +3 \\ \hline \end{array}$$

$$\begin{array}{r} 6 \\ +2 \\ \hline \end{array} \qquad \begin{array}{r} 9 \\ +1 \\ \hline \end{array}$$

SUBTRACTION



Find the differences.

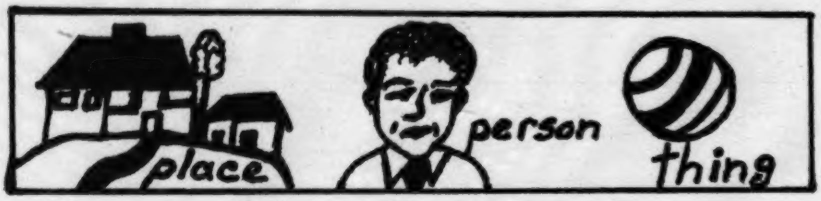
3 − 1 =   5 − 3 =

4 − 3 =   9 − 7 =

2 − 2 =   3 − 0 =

12 − 3 =   10 − 4 =

NOUNS


place
person
thing

Read and find.

The ___ is a person.

cat bus boy

A ____ is a thing.

girl nurse chair

_____ is a place.

tree Texas dog

___ is NOT a noun.

book hen big

Thank you children.

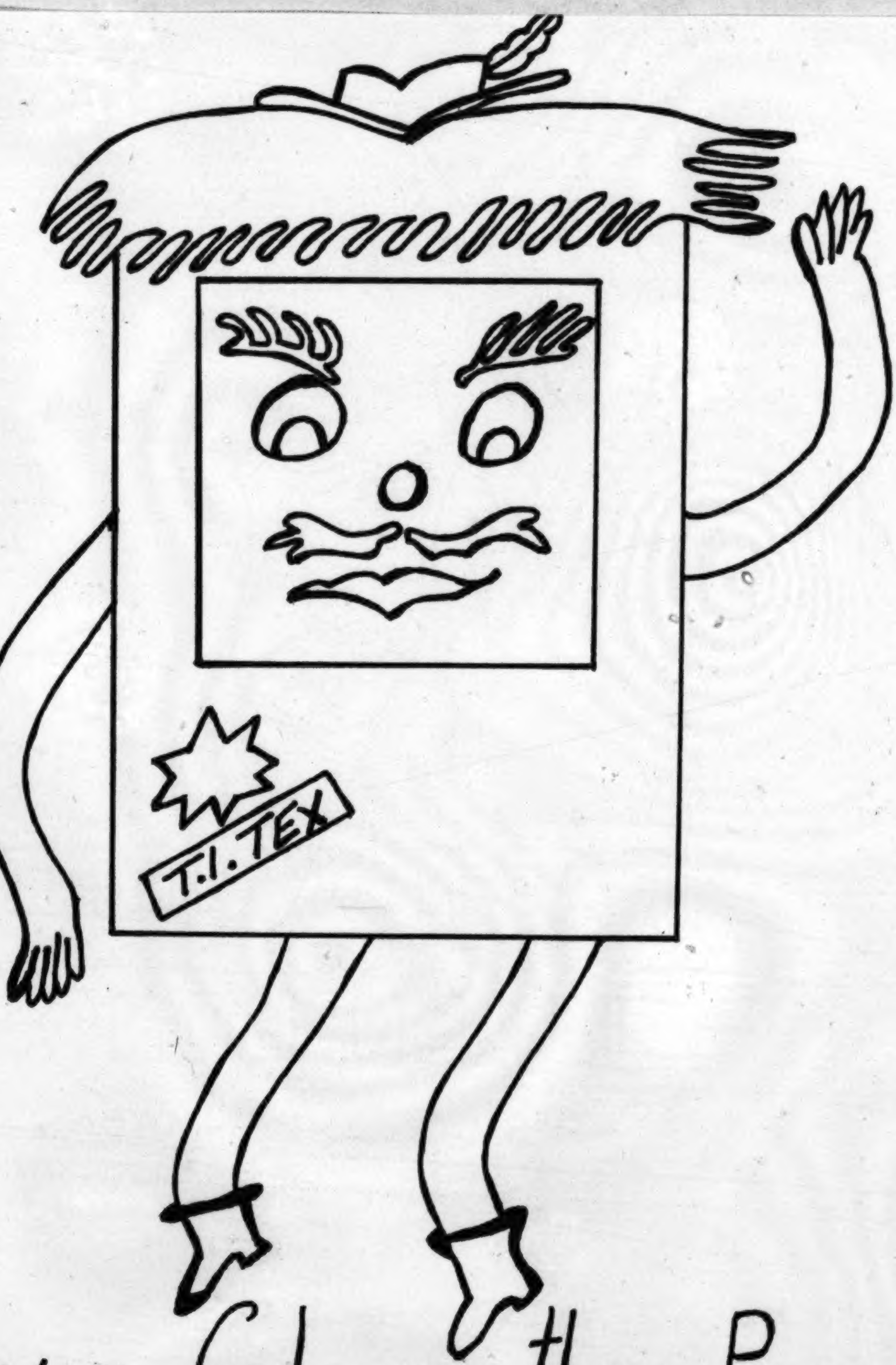
APPENDIX F

COLOURING BOOK

My Colour and Tell
~ Computer Book. ~

Introduction to Computer Assisted Instruction
For Grade 1 Students

Prepared by: M. Butler 1980

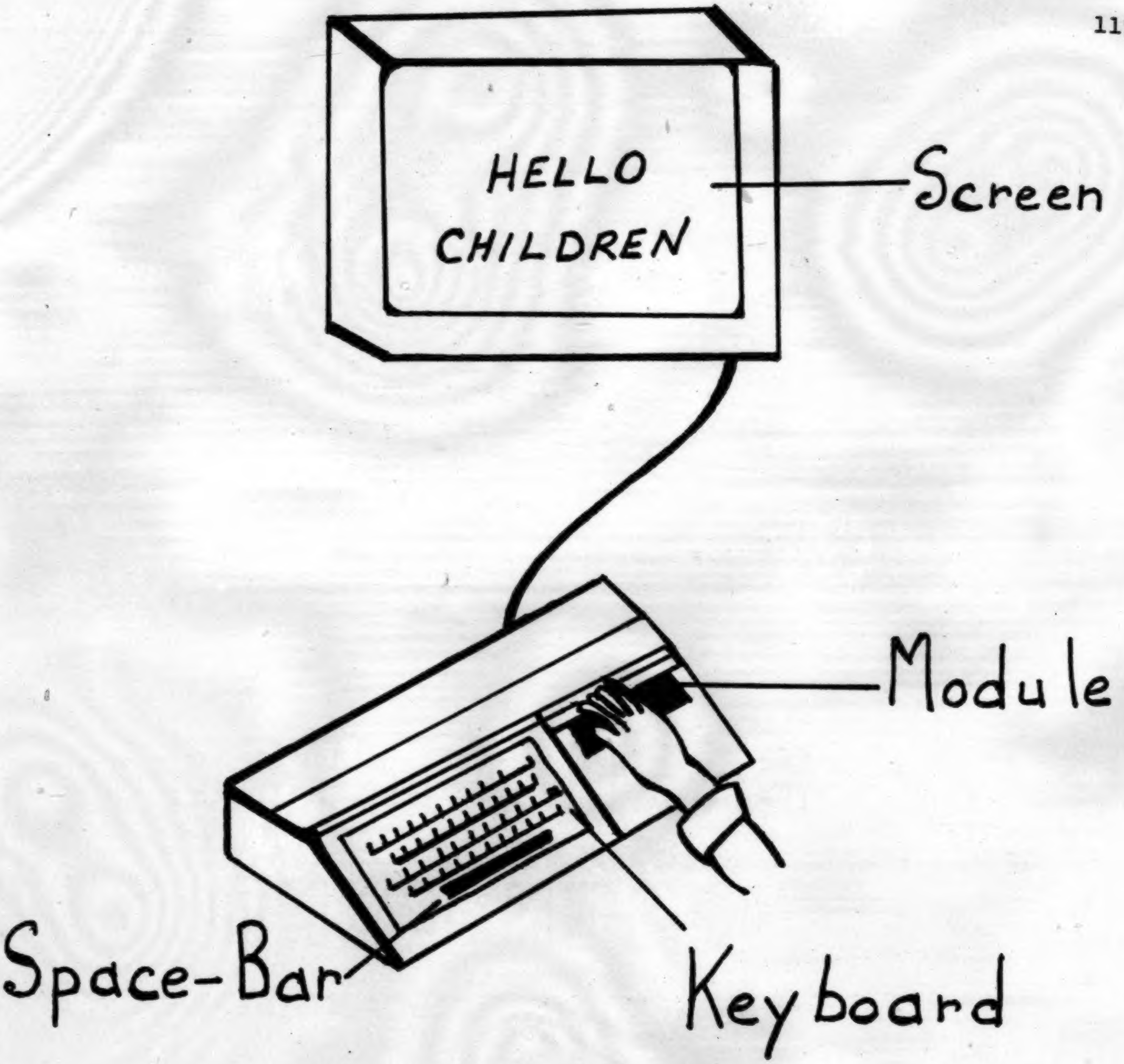


Can you Colour the Puppet?
"T.I. Tex"

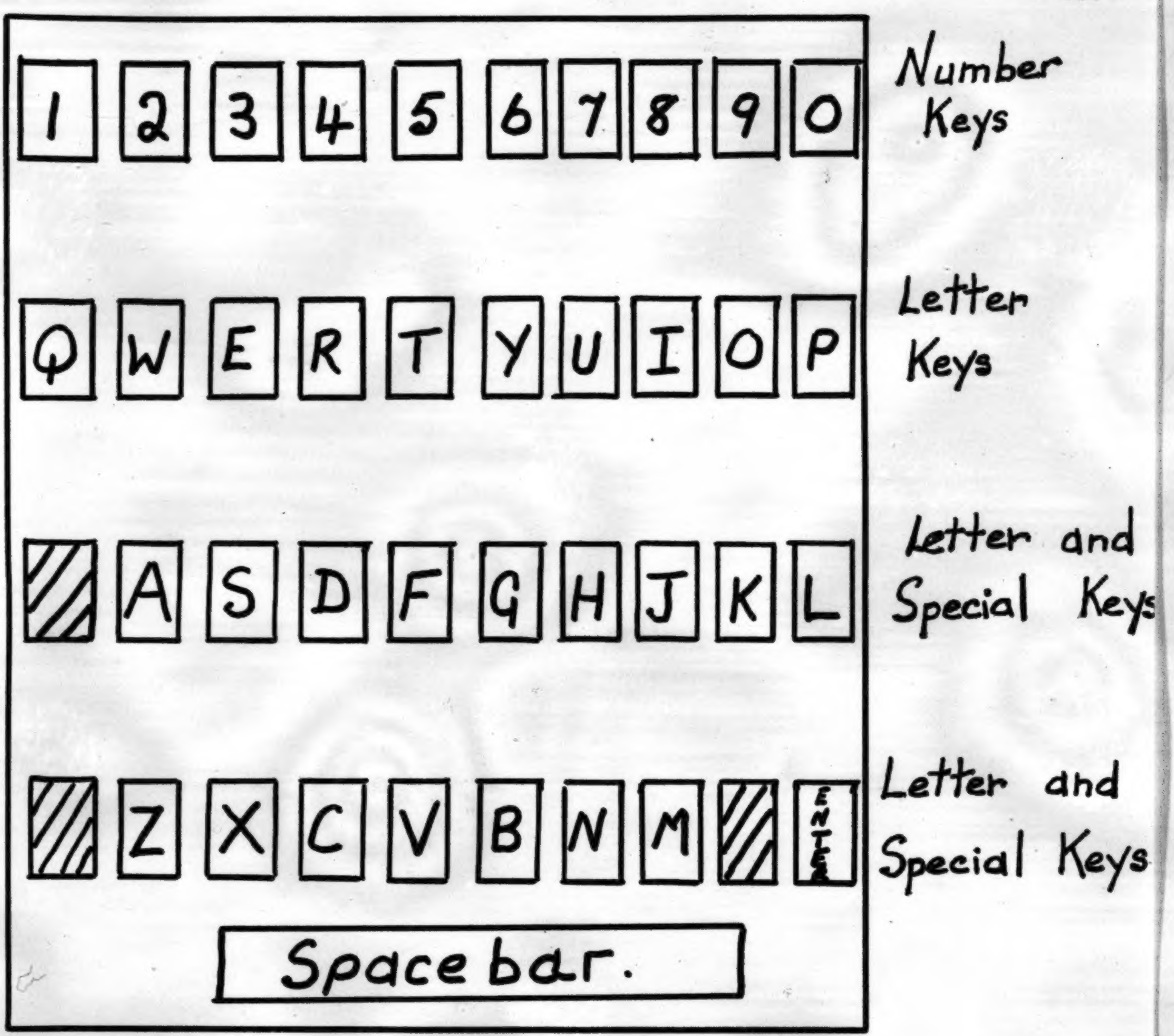
©MRB

Computer
Keyboard
Module
Screen
Space-Bar

New words to tell your friends.


HELLO
CHILDREN
Screen
Module
Space-Bar
Keyboard

Now you can tell your friends the name of each part of the Texas Instruments Computer


1 2 3 4 5 6 7 8 9 0
Number Keys
Q W E R T Y U I O P
Letter Keys
A S D F G H J K L
Letter and Special Keys
Z X C V B N M
ENTER
Letter and Special Keys
Space bar.

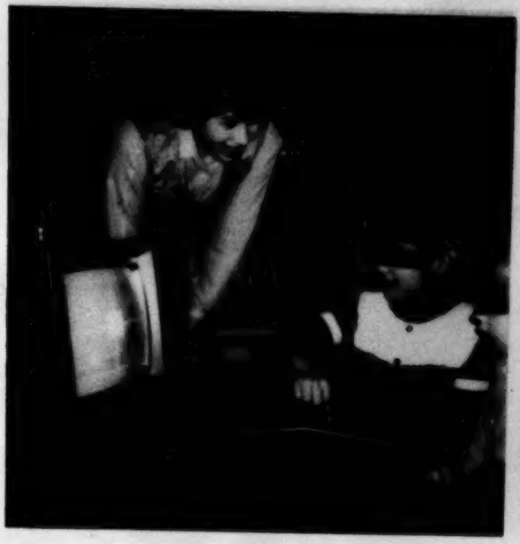
Can you tell me all the Numbers Letters and Special Keys on the Keyboard?

APPENDIX G

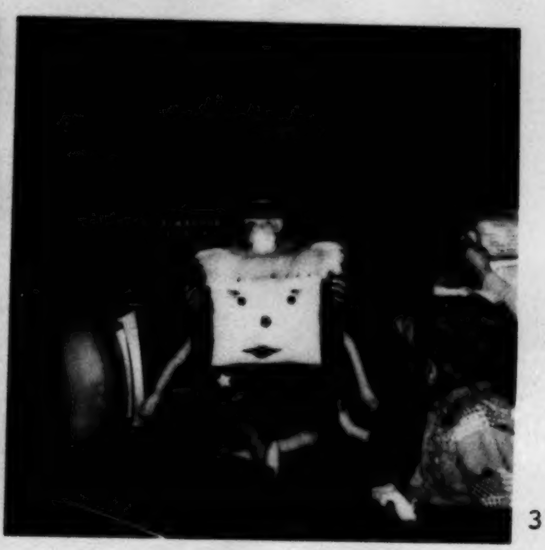
SELECTED PHOTOGRAPHS FROM GROUP ORIENTATION

This is a Computer Keyboard
1 2 3 4 5 6 7 8 9 0
I O P
H J K L
Z X C V B N M
SPACE BAR

1



2

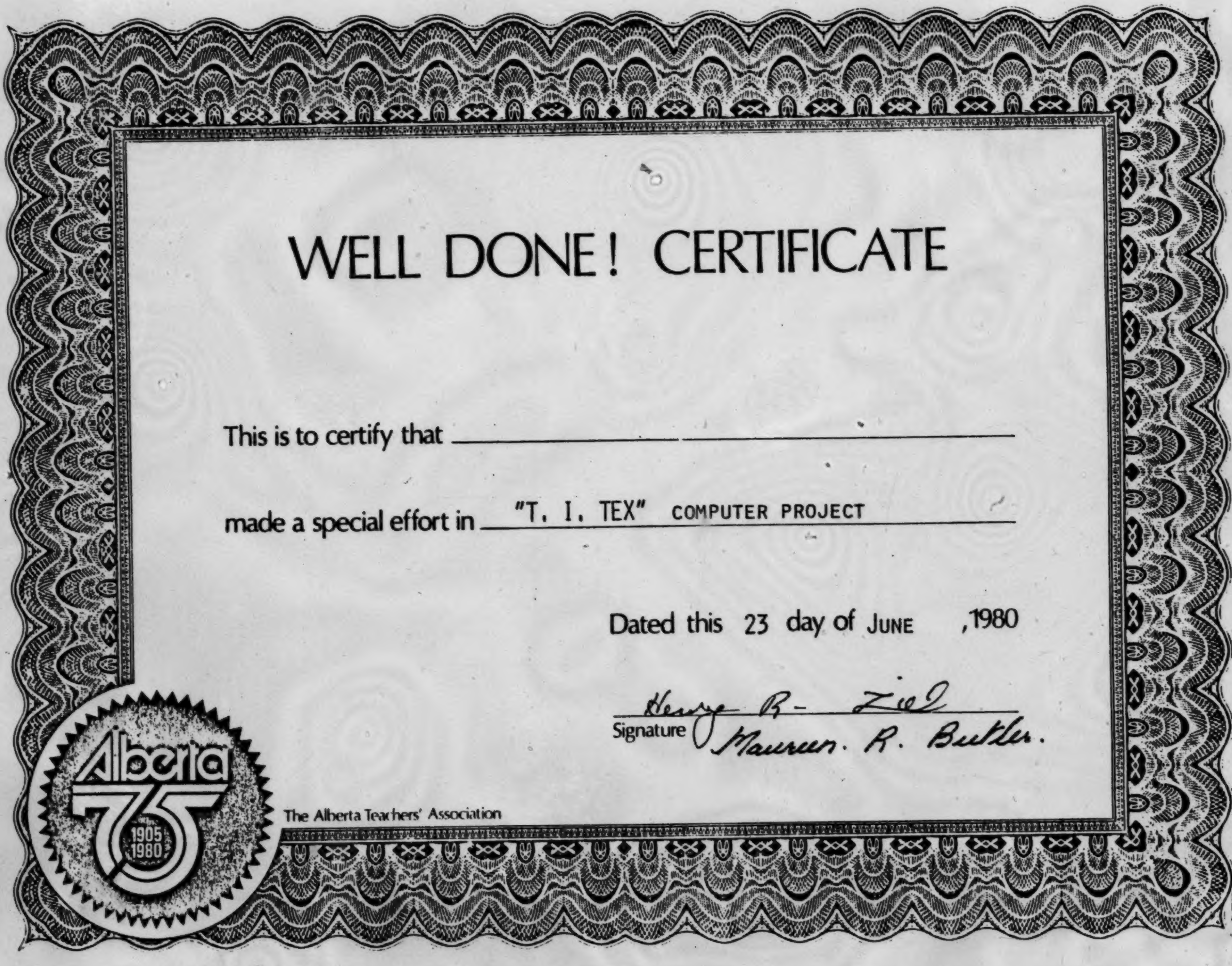


3

1 - Wall poster outlining keyboard
2 - First attempt to use keyboard, reinforced by teacher
3 - The puppet interacts with children and microcomputer

APPENDIX H

"WELL DONE!" CERTIFICATE



WELL DONE! CERTIFICATE

This is to certify that ______________________________

made a special effort in "T. I. TEX" COMPUTER PROJECT

Dated this 23 day of JUNE ,1980

Henry B- Ziel
Signature Maureen. R. Butler.

The Alberta Teachers' Association

APPENDIX I

TEACHERS' COMMENTS

GLENROSE HOSPITAL

10230 - 111 AVENUE
EDMONTON ALBERTA T5G 0B7
PHONE 474-5451

GRADE I COMPUTER PROJECT

The computer program has a strong motivating factor to learning. The children are anxious to participate because: a) They are given the responsibility to "operate" - they are in command. This, in a way, respresents a teacher/pupil role reversal and the children enjoy the challenge of being "in charge"; b) The computer presents a new and exciting method of achievement. It utilizes the major concepts so necessary to primary learning: - to listen, to think clearly, to watch, to understand. The pressure of response is eased; c) The computer awards an immediate reinforcement - an incorrect response is not as 'threatening' in the privacy of a computer/pupil team as it is in a classroom where peer reactions are more open.

I was interested to see the pupils' response and level of achievement in the language (nouns) program. The majority of them have fairly severe speech and language deficiencies. This model, classifying person, place, thing, was a new learning. I feel that the computer has helped very much in terms of teaching a difficult concept. Subsequent classroom lessons show that the children have a better understanding.

Thank you for this opportunity of allowing the children to use an exciting method of learning. They looked forward each day to their turn with T.I. Tex. In the short while you were with us, the children gained much in terms of learning, sharing, taking responsibilities, acceptance, and much more. My personal thanks, Maureen. I've really appreciated your deep concern, your help and

.../2

understanding. The very best in the continuance of your program.

Mickey Kowalski.

Mickey Kowalski (Miss)
Teacher - Glenrose School Hospital

June 4, 1980

GLENROSE HOSPITAL
EDUCATION DEPARTMENT

MEMORANDUM

From: B. Losie **Date:** June 27, 1980

To: M. Butler

Re: Computer in the Classroom

The computer in the classroom has the potential to serve as a motivating introduction to a skill, as practice throughout the teaching of the skill, and an instrument for individual maintenance of a skill. These three uses could be achieved with success if the teacher has a "canned" format into which she/he can plug the exercises suited to the skill being taught at the time.

e.g. Basic facts that can be changed every day.

Matching exercises for vocabulary development - rhyming words (bump, pump, jump, tub, hump - which one doesn't rhyme?); contractions; and other related skills.

PROBLEMS

Vocabulary should be matched to the grade level of the skill. The directions have to be read by the teacher as it is now. The musical reinforcement is good but distracting if only one child is working at the terminal and the rest are doing other activities. This could be remedied through the use of earphones.

B. Losie

BL/pn